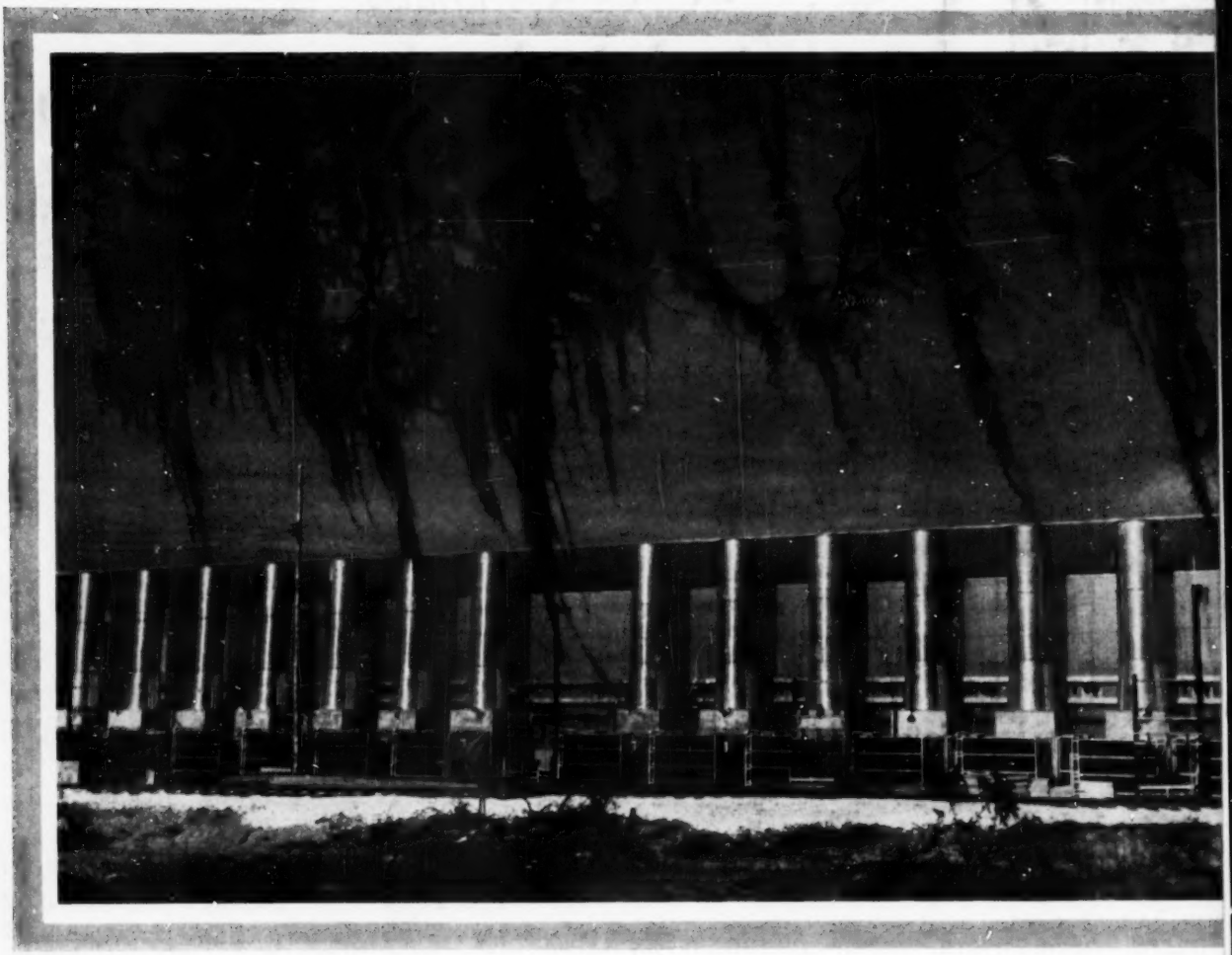
# DIESEL POWER

## AND DIESEL TRANSPORTATION

FEBRUARY, 1952



- ***Kaiser's Chalmette Aluminum Plant***
- ***Evaluating Used Railroad Diesel Engine Oil***
- ***Creston, Iowa, 6000-kw. Cooperative Plant***

# LESS fuel used

# LESS maintenance cost

## ...when you use TEXACO URSA OIL

THIS is a proven fact: Diesel, gas and dual-fuel engines all run cleaner, use less fuel, require less maintenance expense when lubricated with *Texaco Ursa Oil*. The reasons why are these —

*Texaco Ursa Oil* stands up under heat and pressure, resists oxidation. This means freedom from carbon, varnish, sludge. It means free rings for better compression and combustion, real savings in fuel. Wear is reduced, bearings and all moving parts last longer.

There is a complete line of *Texaco Ursa Oils* to meet the requirements of every stationary Diesel engine and every set of operating conditions. They have the O.K. of leading engine builders and operators everywhere. In fact —

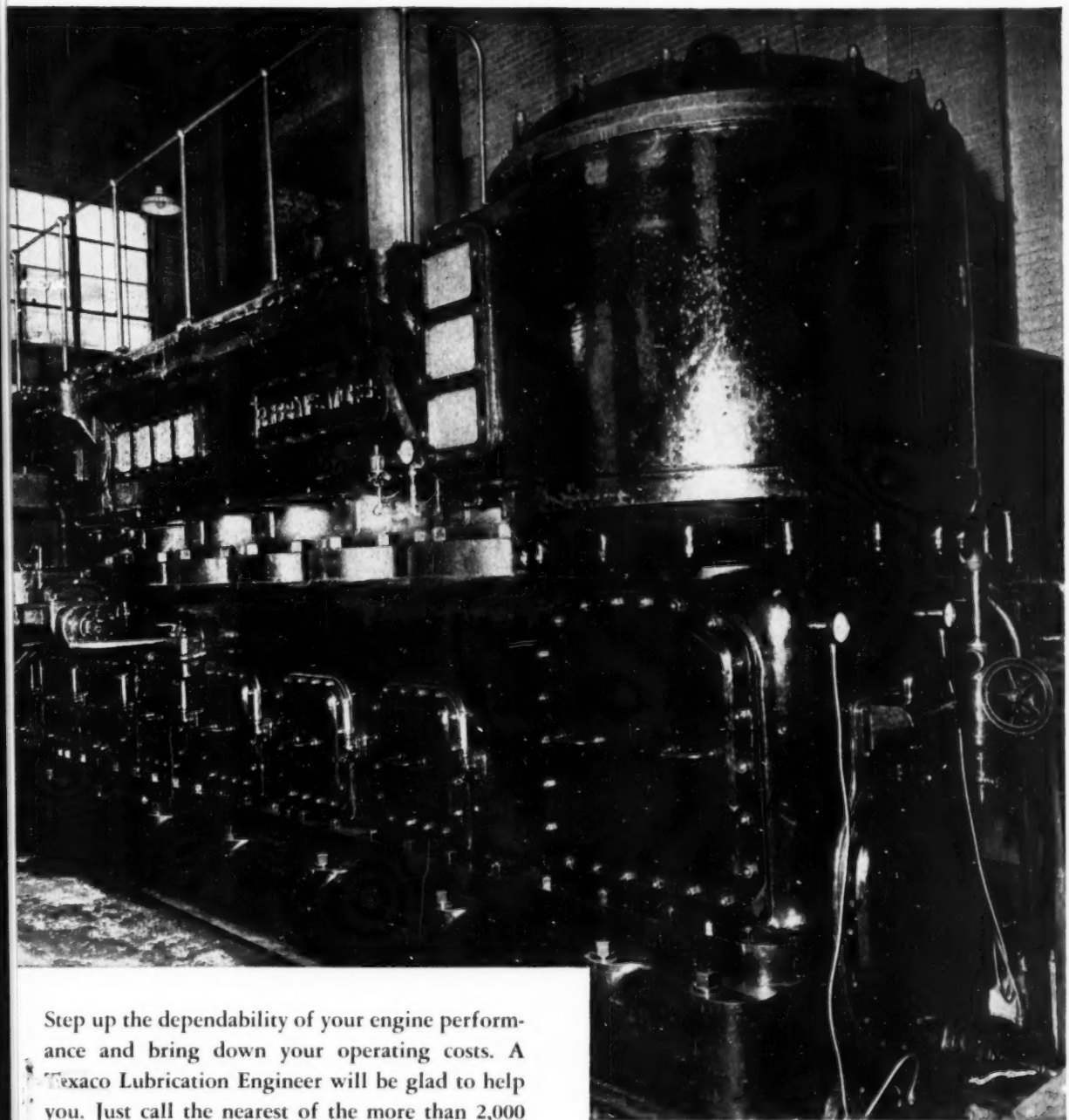
*For over 15 years, more stationary Diesel h.p. in the U. S. has been lubricated with Texaco Ursa Oil than with any other brand.*

**TUNE IN . . .** TEXACO STAR THEATER starring MILTON BERLE on television every Tuesday night. METROPOLITAN OPERA radio broadcasts every Saturday afternoon.

TEXACO

# TEXACO

DIESEL POWER and DIESEL TRANSPORTATION for February 1952, Vol. XXX, No. 2. It is published monthly by Diesel Publications, Inc., Orange, Conn. Executive and Editorial offices at 192 Lexington Ave., New York 16, N. Y. Subscription rates: United States, $3.00 per year, single copies 35¢ Canada $4.00; Foreign $5.00 per year. Entered as second class matter April 29, 1949 at the Post Office, Orange, Connecticut under Act of March 3, 1879.



Step up the dependability of your engine performance and bring down your operating costs. A Texaco Lubrication Engineer will be glad to help you. Just call the nearest of the more than 2,000 Texaco Distributing Plants in the 48 States, or write:

☆ ☆ ☆

The Texas Company, 135 East 42nd Street, New York 17, N. Y.

**URSA OILS** FOR ALL DIESEL, GAS AND DUAL-FUEL ENGINES

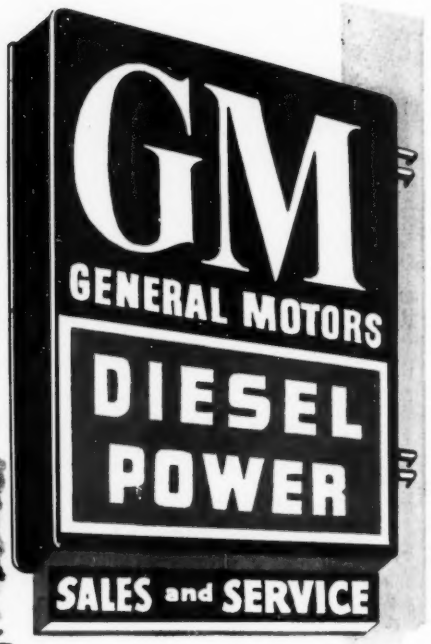
*Faithfully yours*
TEXACO 50
*for Fifty Years*

At your service—

# Everywhere

YOU'LL see this sign wherever you go. General Motors Diesel distributors and dealers are located all along the coastal and inland waters of America—ready to answer your call for quick adjustments, repairs, or factory-engineered parts for Series 71 and 6-110 GM Diesel Engines.

GM Diesel service is available throughout the rest of the world from General Motors Overseas Operations and General Motors Products of Canada, Ltd.



**SEE** *the GM Diesel Display in Space L, Main Floor, at the 1952 National Motorboat Show in New York, January 11-19.*

## Where GM Marine Diesel Service Is Available

**ATLANTIC COAST**

**CONNECTICUT**—Stonington
FISHERMANS REPAIR SERVICE
West Haven
WEST HAVEN SHIPYARDS, INC.

**FLORIDA**—Daytona Beach
DAYTONA BEACH BOAT WORKS, INC.
ft. Pierce
BILL FREE COMPANY
Jacksonville, Miami
GENERAL MOTORS CORPORATION
FLORIDA DIESEL ENGINE SALES
W. Palm Beach
MARINE ENGINE & EQUIP. CO.

**GEORGIA**—Brunswick
BRUNSWICK AUTO PARTS CO.
Savannah
MORGANS, INC.

**MAINE**—Boothbay Harbor
FRANK L. SAMPLE JR., INC.
Machias
LESTER E. YOUNG MACHINE SHOP
Rockland
HUNTER MACHINE CO.
Yarmouth
WALTER H. MORETON CORP.

**MARYLAND**—Baltimore
JOHNSON & TOWERS BALT., INC.
Crisfield
CRISFIELD MACHINE & BOAT WORKS
Eastport
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CROCKETT BROTHERS

**MASSACHUSETTS**—Cambridge
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D. N. KELLEY & SONS, INC.
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CAPE COD MARINE SERVICE, INC.
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EASTERN MARINE SERVICE
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STOWMAN SHIPYARDS, INC.
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DIESEL ENGINEERING & EQUIPMENT CO., INC.
Point Pleasant
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**NEW YORK**—Brooklyn
GENERAL MARINE REPAIR CO.
Flushing
HENRY KNESE SALES & SERVICE INC.

**NORTH CAROLINA**—Beaufort
MACHINE & SUPPLY COMPANY

**PENNSYLVANIA**—Philadelphia
JOHNSON & TOWERS, INC.

**RHODE ISLAND**—Point Judith
POINT JUDITH ENGINE & SUPPLY CO.

**SOUTH CAROLINA**—Charleston
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STEVENS LINE COMPANY

**VIRGINIA**—Gloucester Point
J. H. JORDAN MARINE RAILWAY
Irvington
TIDEWATER MARINE SALES & SERVICE, INC.
Wachapreague
GEO. PEPPLER MARINE RAILWAY
West Norfolk
WESTERN BRANCH DIESEL SALES & SERVICE

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**FLORIDA**—Panama City
BAY MACHINE & WELDING CO., INC.
Tallahassee
SEABROOK TRUCK & TRACTOR CO.
Tampa
GENERAL ENGINE & EQUIPMENT CO.

**LOUISIANA**—Baton Rouge
LOUISIANA MARINE REPAIR SERVICE CO., INC.
Houma
BRADY'S ENGINE CO.
Grand Isle, Harvey
GEORGE ENGINE CO., INC.
Lake Charles
LAKE CHARLES MARINE SALES, INC.

**MISSISSIPPI**—Biloxi
KENNEDY MARINE ENGINE CO.

**TEXAS**—Corpus Christi, Houston
STEWART & STEVENSON SERVICES, INC.
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**INLAND WATERWAYS**

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ARMSTRONG EQUIPMENT CO.

**ARKANSAS**—Morrilton
LOVE SUPPLY CO.
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LEWIS DIESEL ENGINE CO.

**ILLINOIS**—Bellwood
D. D. KENNEDY, INC.
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KOSKI REPAIR WORKS

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MARINE WELDING & REPAIR WORKS

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K C DIESEL POWER CO.
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Wrangell
WRANGELL MACHINE WORKS

**CALIFORNIA**—Berkeley, Ft. Bragg
WEST COAST ENGINE & EQUIPMENT CO.
Eureka
AIKINS & WILLIAMS TRACTOR CO.
Los Angeles Harbor, Newport Beach, San Diego
CROFTON DIESEL ENGINE CO., INC.
Monterey
HOVER EQUIPMENT CO.
San Francisco
SHORE LINE DIESEL MAINTENANCE

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Coos Bay
WOODBURY-LILLEBO COMPANY, INC.
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**DETROIT DIESEL ENGINE DIVISION**
**GENERAL MOTORS · DETROIT 28, MICHIGAN**

Single Engines...32 to 275 H. P. Multiple Units...Up to 800 H. P.

GM
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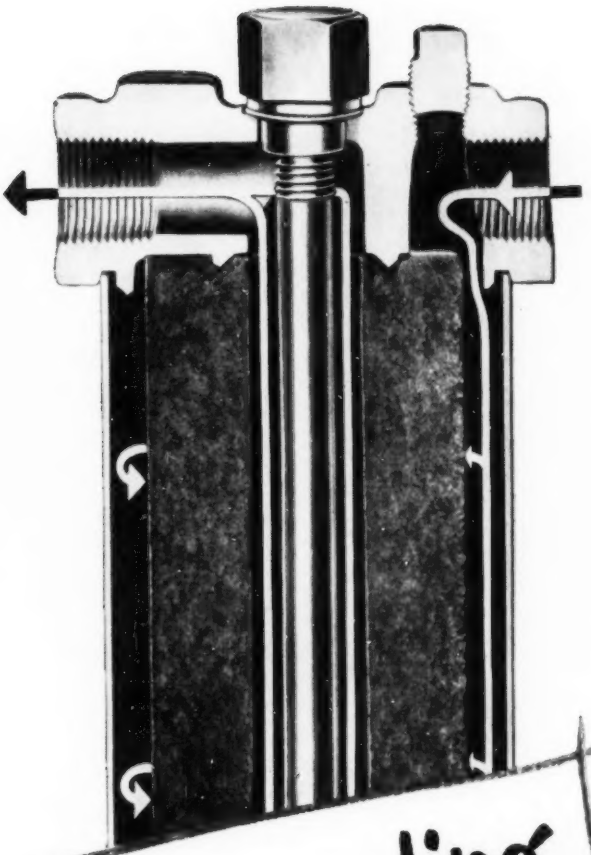
DIESEL
POWER



# No Channeling with this micronic filter

Won't shrink, won't swell. Won't harden, won't soften. Won't distort in any way. That's Cuno MICRO-KLEAN . . . the filter that outlasts any other replaceable-cartridge filter 2 to 1!

## Build *This* into Your Engine Guaranteed Clean Oil

For cleaning Diesel fuel and lube, nothing gives you greater dependability than Cuno MICRO-KLEAN!

It is *guaranteed* to remove 100% of injurious solids larger than specified* plus a large percentage down to 1 micron.

Also, it's impervious to crankcase acids, moisture or other damaging agents. Will not distort, shrink, or rupture. Prevents clogged injector nozzles or damage to working parts.

## Fewer Cartridge Changes

Maximum porosity (85-90%) of fibre-felted cartridge and exclusive "graded density in depth" reduce surface-loading and produce *double* the usual dirt-holding and flow capacity.

## Less Space Needed

Greater capacity and absence of structural components cut down space needed. Thus, full-flow filtration of lube is now practical.

## No Danger of Removing Additives

Filtration is accomplished by mechanical principles—no adsorptive or absorptive properties. Additives are not removed.

*Cuno MICRO-KLEAN cartridges are available in 10, 25 and 50 micron ratings. Capacities from a few to over 800 gpm.

CUNO

*Fluid Conditioning*

**Removes More Sizes of Solids from More Kinds of Fluids**

**Strain** fuels, lubricants, process fluids, etc.—AUTO-KLEAN
**Filter** fuels, lubricants, process fluids, etc.—MICRO-KLEAN
**Clean** raw water, recirculating water, etc.—FLO-KLEAN

**Cuno Engineering Corporation**
**Dept. 256D, South Vine St., Meriden, Conn.**

Please send information on Cuno MICRO-KLEAN for Diesel service.

Name.....Title.....

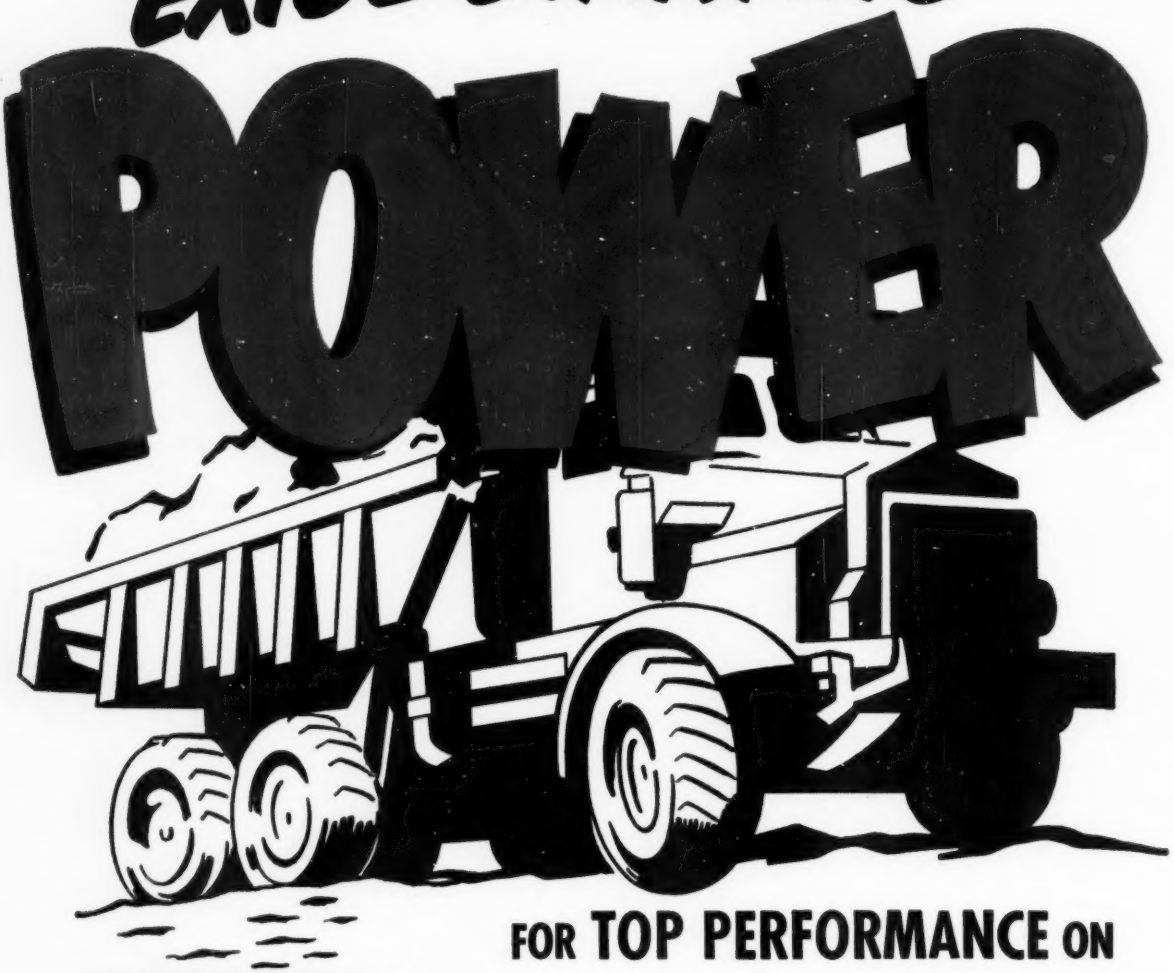
Company.....

Address.....

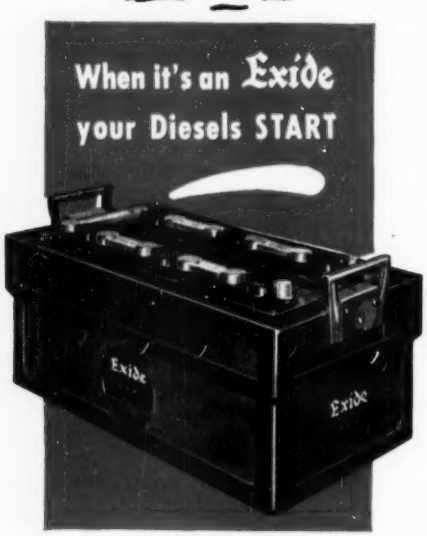
City.....Zone....State....

Please attach to business letterhead

# EXIDE STARTING POWER



## FOR TOP PERFORMANCE ON ALL DIESEL-STARTING JOBS




For STARTING DEPENDABILITY, choose Exide Batteries. They're built specifically for the job . . . built in types and capacities for ALL diesel-starting applications. Each is a development of years of exacting research and engineering to give you batteries that will withstand the rigors of all climates and hard, rugged service. In Exide Diesel-Starting Batteries you get:

**QUICK BREAKAWAY** and fast acceleration of engine to firing speed.

**LOW DEPRECIATION** due to their extra long life.

**LOW COSTS** of operation and maintenance.

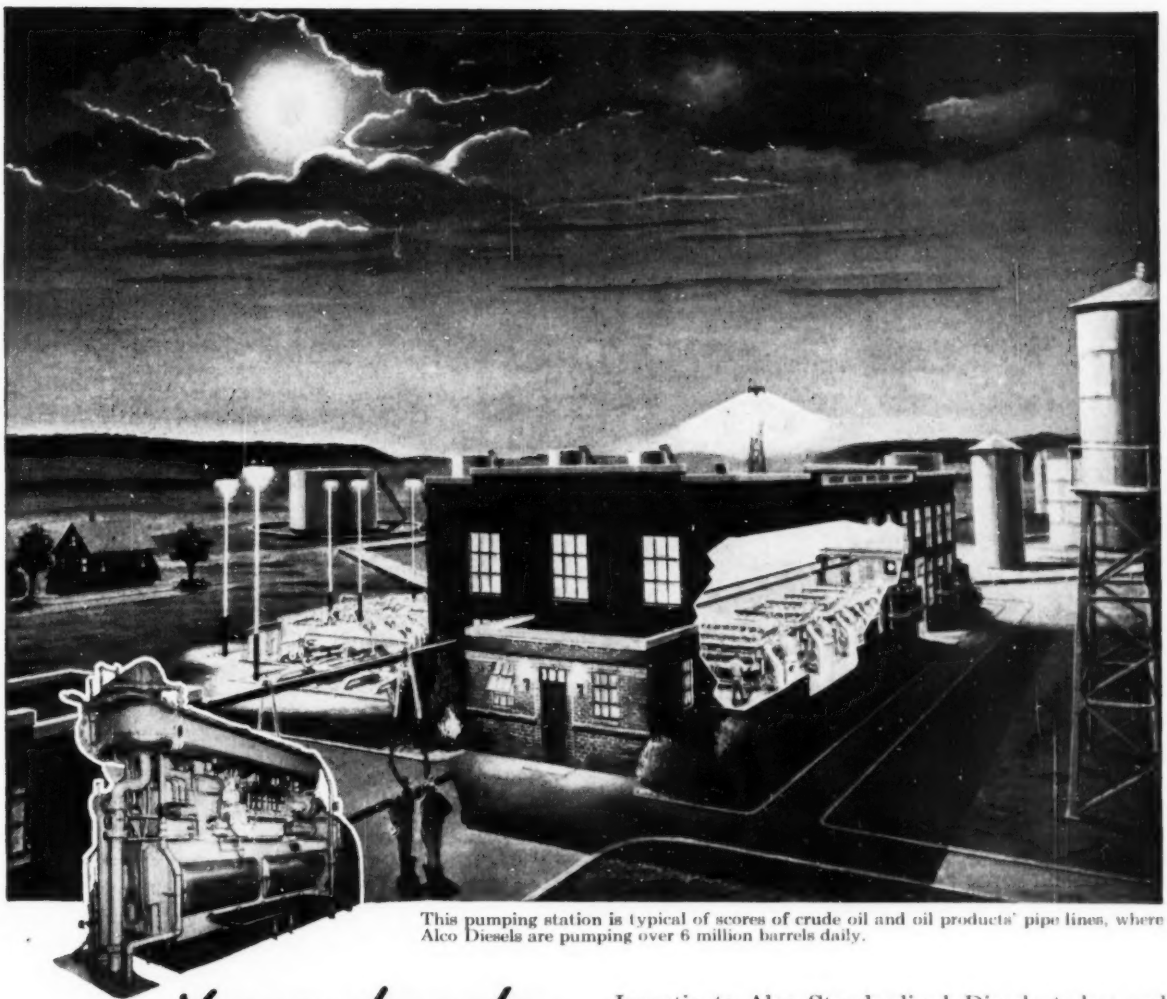
**RUGGED CONSTRUCTION** for rough usage in hard service.

Use Exide Diesel-Starting Batteries for all heavy-duty services—in buses, trucks, tractors, off-the-highway equipment, ships, power plants, diesel-electric locomotives.

THE ELECTRIC STORAGE BATTERY COMPANY
Philadelphia 2
*Exide Batteries of Canada, Limited, Toronto*
"Exide" *Reg. Trade-mark U.S. Pat. Off.*

*1888 . . . DEPENDABLE BATTERIES FOR 64 YEARS . . . 1952*

# they never sleep



This pumping station is typical of scores of crude oil and oil products' pipe lines, where Alco Diesels are pumping over 6 million barrels daily.

## You can depend on ALCO DIESELS

Experienced pumping station superintendents say they want engines that stay awake . . . and can be depended upon for long periods of operation with minimum maintenance. That's why so many of them prefer Alco Standardized Diesels. For example, 37 Alco engines rolled up 814,752 hours with only .02% hours unscheduled shutdowns, in one typical installation.

Pumping station superintendents like Alco Economy, too.

- **Compactness means lower building costs.**
- **Higher engine efficiency means lower fuel costs.**
- **Flexible power range means easy expansion.**
- **Medium speed design cuts ⅓ the cost of principal auxiliary equipment.**

Investigate Alco Standardized Diesels today and find out why in the last 10 years *more of these engines have been installed in oil pipe line pumping service in the United States and Canada than any other make.* Contact your nearest American Locomotive Company Sales Office at Beaumont, Chicago, Cleveland, Houston, Kansas City, New York, San Francisco, Schenectady or St. Louis.

**ALCO DIESELS**

THE MARK OF MODERN ENGINEERING

AMERICAN LOCOMOTIVE COMPANY

IN TEN YEARS' OPERATION...

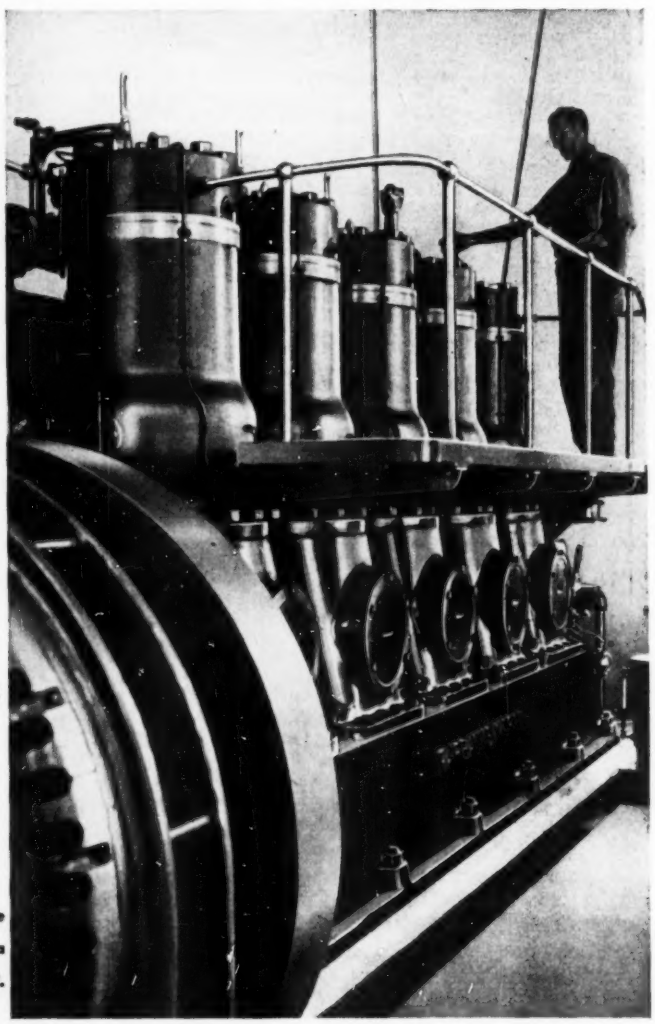
# "Never Shut Down, Never Changed A Cylinder Liner!"

...CITY OF GRESHAM POWER AND LIGHT CO., WIS.

● The City of Gresham Power & Light Company of Gresham, Wis. has two Fairbanks-Morse diesels and two hydro-electric units driven by water power. In the diesels, Mr. M. Fisher, Plant Superintendent, has been using Sinclair Gascon D. One of the engines has used this oil for 10 years.

Mr. Fisher reports that these diesels are running at high efficiency, and hardly ever need attention. He says, "We are getting ideal operation with no appreciable ring wear. We have never had a shutdown due to mechanical failure and have never changed a cylinder liner. I have a lot of confidence in this engine and in Gascon Oil."

Sinclair Gascon® Oil can save wear, trouble, and retard replacement in your diesels, too, as it has in scores of installations throughout the country. For more details of this fine lubricating oil, phone or write your local Sinclair Representative or write direct to Sinclair Refining Company, 600 Fifth Avenue, New York 20, N. Y.

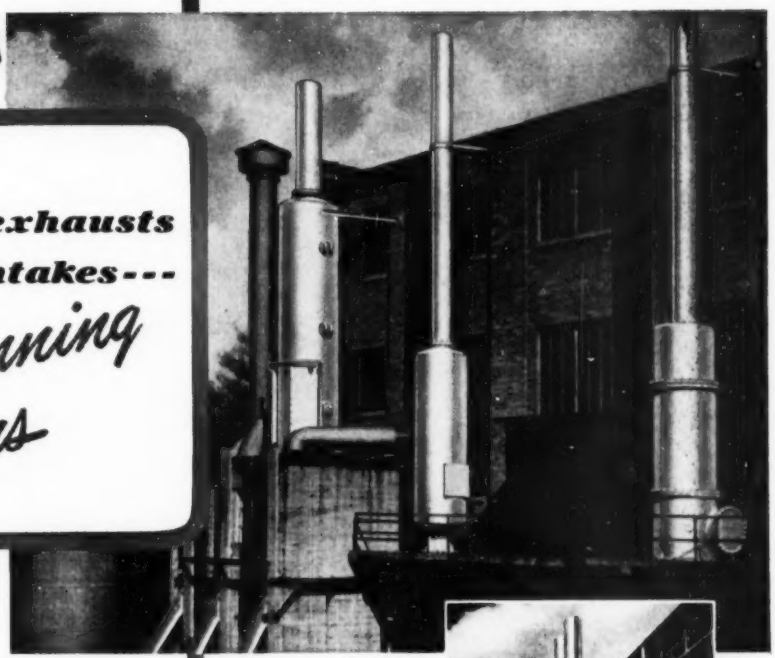


**The 5 cyl. Fairbanks-Morse, 375 hp., 300 rpm. diesel of the City of Gresham Power & Light Co. plant. This runs 16 hours a day, needs little attention, thanks to Sinclair Gascon Oil.**

## Sinclair Diesel Lubricants

SAVE WEAR AND REPLACEMENT

POWER STATION



***For quiet engine exhausts and compressor intakes--- select***

# *Burgess-Manning Snubbers*

● In utilities and manufacturing plants, on Diesel locomotives and boats, in the chemical and petroleum industries..on engines and compressors of all sizes and makes, you will find Burgess-Manning Snubbers effectively quieting the pulsating roar from engine exhausts and the throbbing suction of compressor intakes. Burgess-Manning Snubbers are scientifically designed to smooth the flow of exhaust gases and intake air. Noise is reduced to the desired sound level. Performance of equipment improved. Reduced maintenance.

For a practical solution of your engine and compressor noise problems call Burgess-Manning: sound engineering recommendations; sturdily constructed, reliable products; guaranteed performance.

## BURGESS-MANNING COMPANY

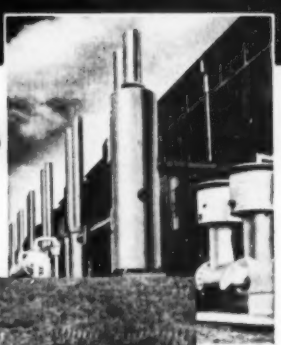
**749 East Park Avenue, Libertyville, Illinois**

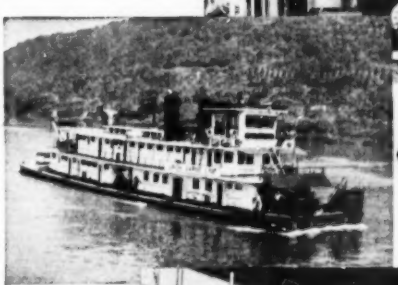
**YOU CAN DEPEND UPON BURGESS-MANNING ENGINEERS FOR A QUALITY PRODUCT AND SOUND ENGINEERING COUNSEL**

- A quarter century's experience.
- Engineering and installation know-how gained by work in hundreds of industries.
- Broad line of Snubbers in a wide range of sizes and noise reduction capacities.

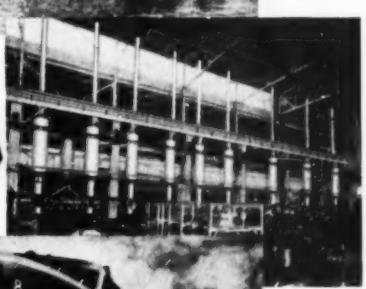
*Write for Bulletin*
"Bring Your Plant Up To Date With Burgess-Manning Heavy-Duty Slug Buster Snubber."

PIPE LINE STATION

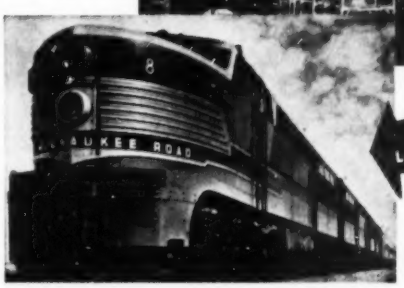




BARGE

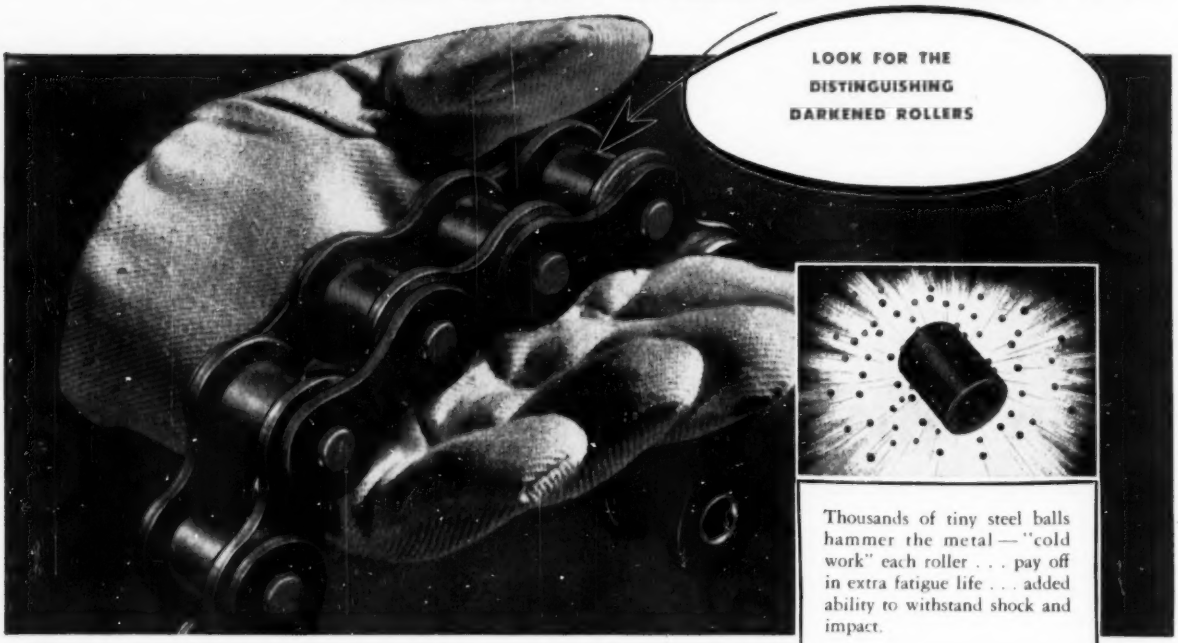


ENGINE TEST HOUSE




DIESEL LOCOMOTIVE

# Here's how you can tell the chain with SHOT-PEENED rollers...




Thousands of tiny steel balls hammer the metal — "cold work" each roller . . . pay off in extra fatigue life . . . added ability to withstand shock and impact.

## ...the chain that has extra fatigue life

YES, you want to be sure you get shot-peened rollers on the next roller chain you buy. Shot-peening gives rollers the extra fatigue life needed to take repeated shock and impact loads.

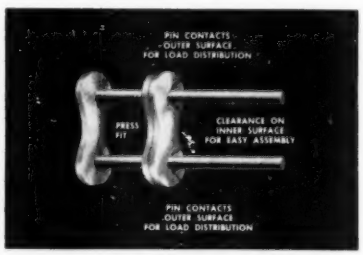
These chains are high in tensile strength, durable under severe loads, relatively light in weight and uniform in pitch. This accounts for their wide acceptance throughout industry for both drive and conveying purposes.

Thanks to constant research and precise manufacturing controls, every Link-Belt Precision Steel Roller Chain meets the highest standards for uniform strength. You get a positive, long-life drive — unaffected by heat, cold or moisture.

Link-Belt Roller Chain is available in single or multiple widths, in 3/8 to 3 in. single and double pitch. For all the facts, call your nearest Link-Belt office.

**LINK-BELT**

**PRECISION STEEL ROLLER CHAIN**

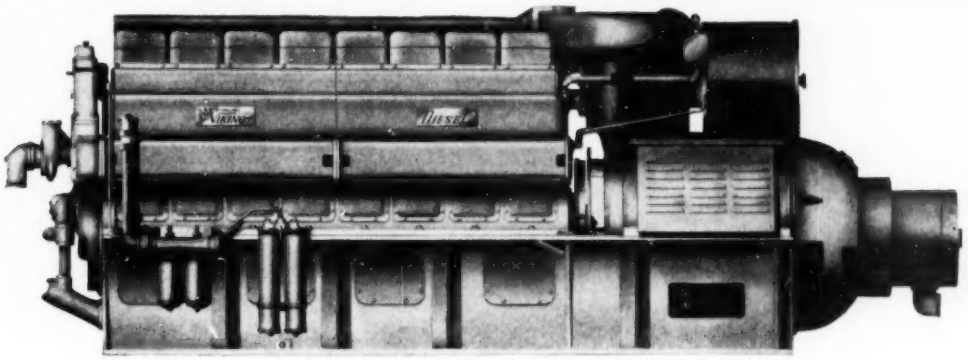



### Easier coupling
**and uncoupling without sacrificing load distribution**

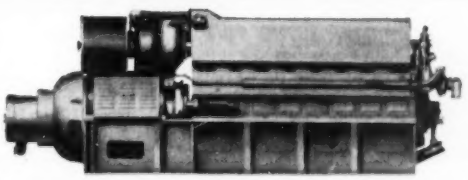
Patented E-Z Assembly feature of Link-Belt Precision Steel Roller Chain has won world-wide approval. Coupling and uncoupling of multiple-width chains — right on the job — is far easier. There's absolutely no sacrifice of load distribution . . . no loss of the chain's remarkable performance. Press-fits between chain pins and middle bars have been modified. But full load carrying capacity across the entire width of the chain has been maintained.

LINK-BELT COMPANY: Indianapolis 6, Chicago 9, Philadelphia 40, Atlanta, Houston 1, Minneapolis 5, San Francisco 24, Los Angeles 33, Seattle 4, Toronto 8, Springs (South Africa). Offices, Factory Branch Stores and Distributors in principal cities. 12.332

# Sterling Viking Diesels definitely lower costs of power production



Model VDS-8S, 600 KW Generator Set. Viking Diesel "packaged unit" generator sets are available in 6 and 8 cylinder models. Bulletins 1024 and 1028 contain sectional views, fuel consumption curves, engineering and installation details. Sent on request.



We have the evidenced facts to show any user of diesel electric generator sets that the newly engineered Sterling Vikings can cut KW hour production costs by as much as 50 per cent.

Fuel consumption, engine weight, compactness, housing, installation, parts cost, general maintenance — all are factors in the service worth of a generator set. On every point Vikings offer proven advantages confirmed by comparison. In diesel engineering, Sterling has come up with design developments that have the industry talking. We would like to give you this story of lower power costs first hand. Write us for latest Sterling Viking Diesel literature.

Sterling

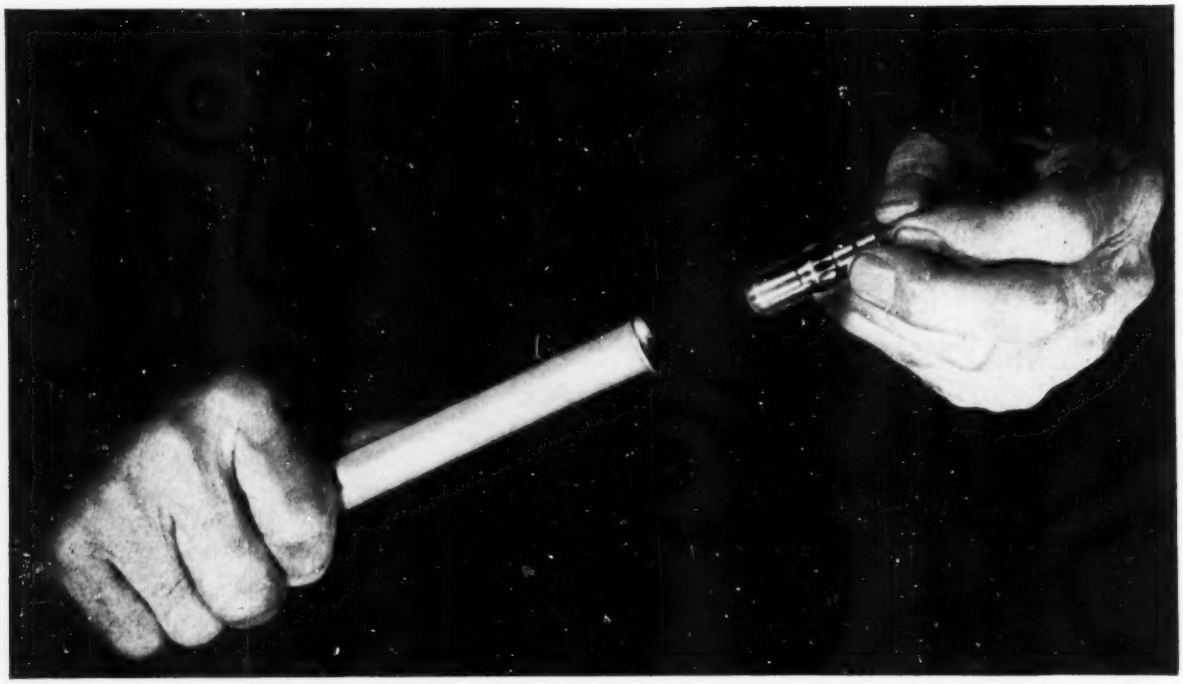
MARINE AND INDUSTRIAL

**ENGINES**

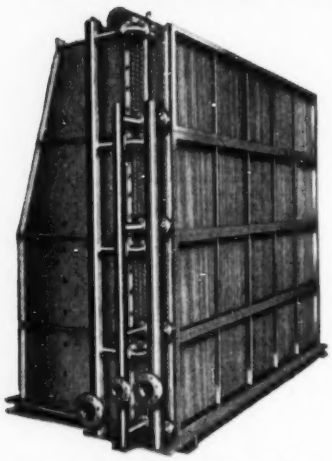
Diesel, Gasoline, Gas—4, 6 and 8 cylinder—30 HP to 1,000 HP

● Depend upon Sterling Diesel Power for Locomotives, Generator Sets, Commercial and Fishing Craft, Lift Bridges, Ventilating Systems, Drilling Rigs, Etc.

STERLING ENGINE COMPANY • 1270 Niagara Street • Telephone LIncoln 0382 • Buffalo 13, New York



# The bullet that helps keep engines cool



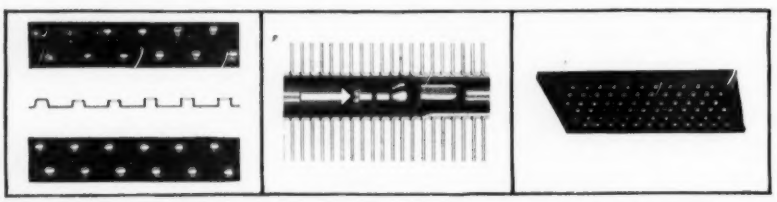
A TRANE Fluid Cooler typical of the hundreds that have been used to cool engine jacket water at the new Point Comfort Works of the Aluminum Company of America at Port La Vaca, Texas.

Secret of the high efficiency of TRANE Fluid Coolers for cooling engine jacket water and lube oil is a bullet. This bullet is shot through tubes in the final step in the creation of the core for the fluid cooler. It expands the tubes into the collars of the fins to form the exclusive TRANE mechanical bond. That bond is as permanent as the metals that form it and as strong as though fin and tube were one. There is no solder or brazing—heat transfer surface is smooth and uninterrupted. Through countless expansions and contractions the same high core efficiency is maintained. Thanks to the bullet and the bond it makes, the TRANE Fluid Cooler operates at high heat transfer efficiency over long periods of service.

The mechanical bond, however, is but one of many features of TRANE Fluid Coolers. Others include construction so rugged that units can be used for stationary or portable installations without additional bracing—mated fans and inlet orifice rings to assure low horsepower consumption—easy accessibility for quick cleaning and maintenance—adjustable pitch fans in larger units so that fan horsepower may be reduced when temperatures are lower.

The TRANE Fluid Cooler is available in 22 standard sizes to cover a wide variety of applications without special construction. They are finished with a weatherproof rubber base paint. A variety of drives can be used.

For more information concerning TRANE Fluid Coolers and the cooling of engine jacket water and lube oil, contact the TRANE sales office nearest you.



**Built-In Precision**—Collars on the fins used in the core of the fluid cooler are belled for accurate spacing and increased heat transfer efficiency.

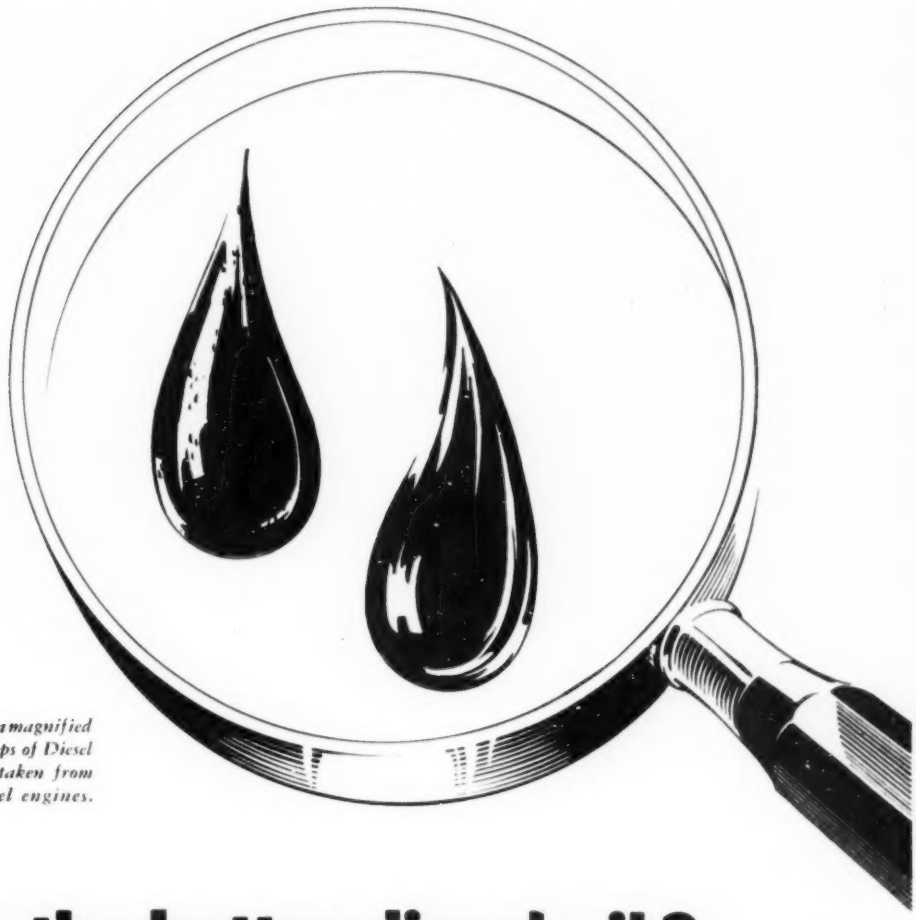
**Uniform Expansion**—How the bullet expands the copper tube into the collars of the fin to form a perfect and lasting mechanical bond.

**For Greater Strength**—Heavy support plates strengthen and protect the coil—typical of the strength built into TRANE products.

**TRANE**

MANUFACTURING ENGINEERS
OF HEATING, VENTILATING,
AIR CONDITIONING AND
HEAT TRANSFER EQUIPMENT

THE TRANE COMPANY, LA CROSSE, WISCONSIN
Eastern Mfg. Division . . . Scranton, Pennsylvania
Trane Company of Canada, Ltd. . . . . Toronto
OFFICES IN 80 U. S. AND 14 CANADIAN CITIES



*Drawn above is a magnified view of two drops of Diesel lubricating oil taken from two new Diesel engines.*

# Which is the better diesel oil?

Chances are, you'd pick the clear clean oil on the right as the better oil . . . but you'd be wrong.

The clean oil is the "lazy" non-detergent oil. It has done a job of lubricating, but it has not done a proper cleaning job.

The better oil is the dirty oil. Its job has been well done. Not only did it provide complete, protective lubrication, but it actually washed the engine! . . . carrying out of the engine those microscopic, insoluble particles that would normally form harmful incrustations on vital engine parts.

The oil holding the dirt particles in suspension is Cities Service D-C 300 . . . one of the complete line of Cities Service Diesel Engine Oils. Its detergent-dispersant and anti-oxidation qualities assure longer, more trouble-free Diesel operation. This high V. I. heavy duty oil guarantees complete lubrication protection at highest engine speeds.

Why not discuss your operation with a Cities Service Lubrication Engineer. His experience and the complete line of scientifically-formulated Diesel lubricants can mean improved operating conditions for you. Write to CITIES SERVICE OIL COMPANY, Dept. B 12, Sixty Wall Tower, New York City 5 . . . or call the Cities Service Office nearest you.

**CITIES SERVICE**

**QUALITY PETROLEUM PRODUCTS**

# They like things

In booming Texas they're thinking way ahead—intelligently planning for future load growth. At Robstown, for instance, the city fathers will soon accept delivery of a big 6-cylinder, 2900 hp Hamilton engine that will provide plenty of power for future needs.

A dual-fuel unit, this 21½ x 27½ engine burns either gas or the heaviest diesel fuel with equal efficiency. And it has all those other features which have made the Hamilton Model 21-SA—one of the few large diesels completely re-engineered since the war—so outstanding in performance.

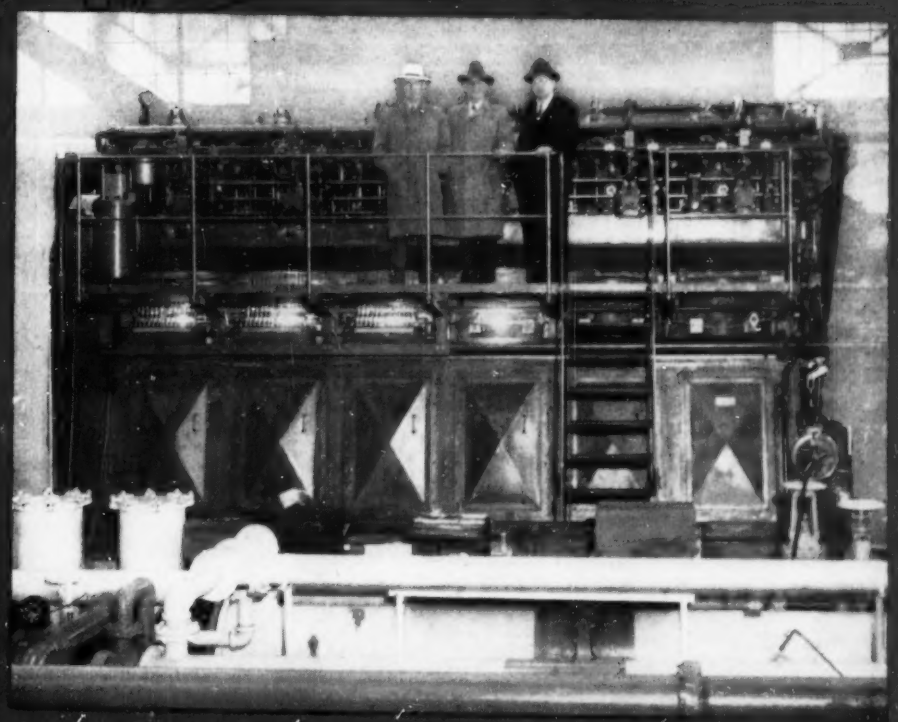
**SQUISH ACTION!** Important secret of this superior performance is Squish Action—a *better* way to use fuel. Because of *exclusive* rotary valve design, an annular well chamber, proportioned porting and a semi-hemispherical combustion chamber—*40% more air is trapped in the cylinder.* Then forced into the fuel spray cone just as the piston reaches top dead center.

The result . . . far better efficiencies in fuel consumption . . . more power . . . less engine wear . . . less maintenance . . . a cleaner, cooler exhaust.

**WRITE!** If you are looking for marine or stationary diesels *remember* there's a conservatively rated Hamilton or Baldwin-De La Vergne unit for virtually any job in the slow and medium speed range from 550 to 6860 hp. Why not write today.

big in Texas

...including this big Hamilton Dual-fuel Engine for Robstown



"Extremely impressed" was Mr. Lee Calloji (Center) Plant Superintendent and Chief Engineer of Robstown, Texas, at the efficiencies in fuel and pilot oil as shown by the Robstown engine during a test at Hamilton. Others shown: Mike Kelleher (Left), Hamilton representative in Texas and Gene Birst, Hamilton Supervisor of Service.

BALDWIN 8LH LIMA-HAMILTON

LIMA-HAMILTON DIVISION • BALDWIN-LIMA-HAMILTON CORPORATION • HAMILTON, OHIO

BALDWIN-LIMA-HAMILTON

# NEW

## continuous protection for your diesel engine

The new Alnor Pyrotac brings you the constant protection you've been wanting for your Diesel engine—an instant check of all cylinder temperatures, *at a glance.*

This precision-built instrument continuously monitors exhaust temperatures . . . automatically checks each cylinder every minute. Watching the pyrometer scale from as far away as 20 feet, you can instantly tell if any one cylinder is out of balance . . . allows supervision by a minimum force. The instrument can be wired to an alarm circuit to warn of excess temperatures and automatically shut down the engine when maximum safe temperatures are exceeded. The pointer on the selector switch will stop at the number of the offending cylinder . . . exactly locating the source of trouble.

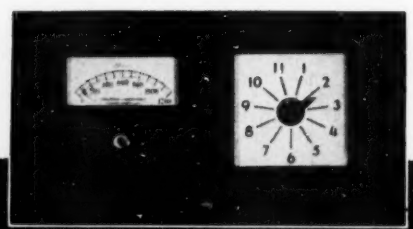
Such automatic, constant protection reduces maintenance time and expense to a minimum—increases efficiency and operating economy.

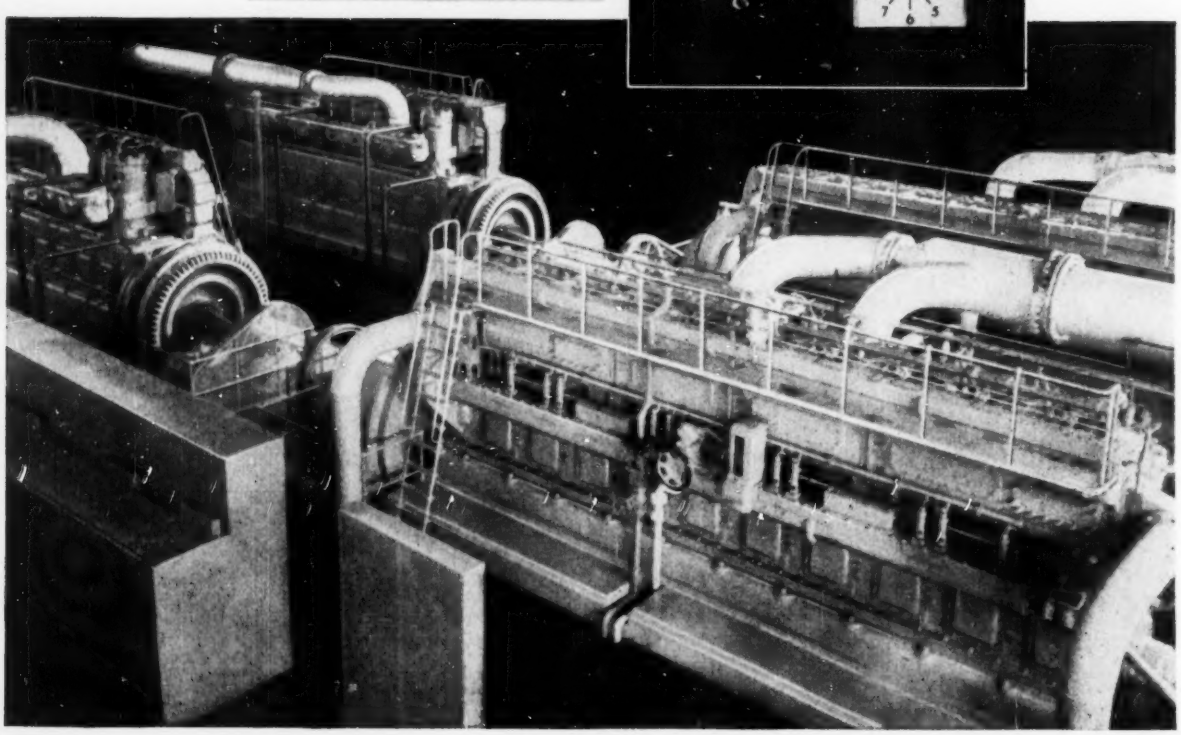
The Pyrotac presents many opportunities for improved instrumentation in the Diesel and gas engine field. It can be used to warn of excess temperatures in cylinders, entire engines, overheated bearings, burn-out danger in fields of large generators, etc. Why not ask for Alnor assistance in solving your pyrometer problems today? Illinois Testing Laboratories, Inc., Room 507, 420 N. La Salle St., Chicago 10, Ill.

**THE ALNOR PYROTAC**
*available in several multi-circuit models.*

*Alnor*

**PRECISION INSTRUMENTS FOR EVERY INDUSTRY**





# KEEP THEM CLEAN-

## maintenance costs low

## with GULF DIESELMOTIVE OIL

***it's performance proved by thousands of service hours in hundreds of Diesels***

Here is the oil that provides protection plus for industrial, workboat, and railway Diesels—Gulf Dieselmotive.

Made from 100% solvent-refined oil, it does not form harmful metal-like deposits on piston crowns, especially important where the same oil is in service for a long period of time.

Gulf Dieselmotive Oil has effective detergent-dispersant action, which helps keep oil-control and compression rings clean and free, and retards sludge deposits. As a result, wear and oil consumption are remarkably low.

Gulf Dieselmotive Oil also has outstanding resistance to oxidation and the formation of crankcase sludge. Of course it's nonfoaming and noncorrosive to silver bearings.

These advantages add up to cleaner engines, reduced cylinder wear, and lower maintenance costs, as reported by scores of Diesel operators who have used Gulf Dieselmotive Oil for thousands of hours in many types of service.

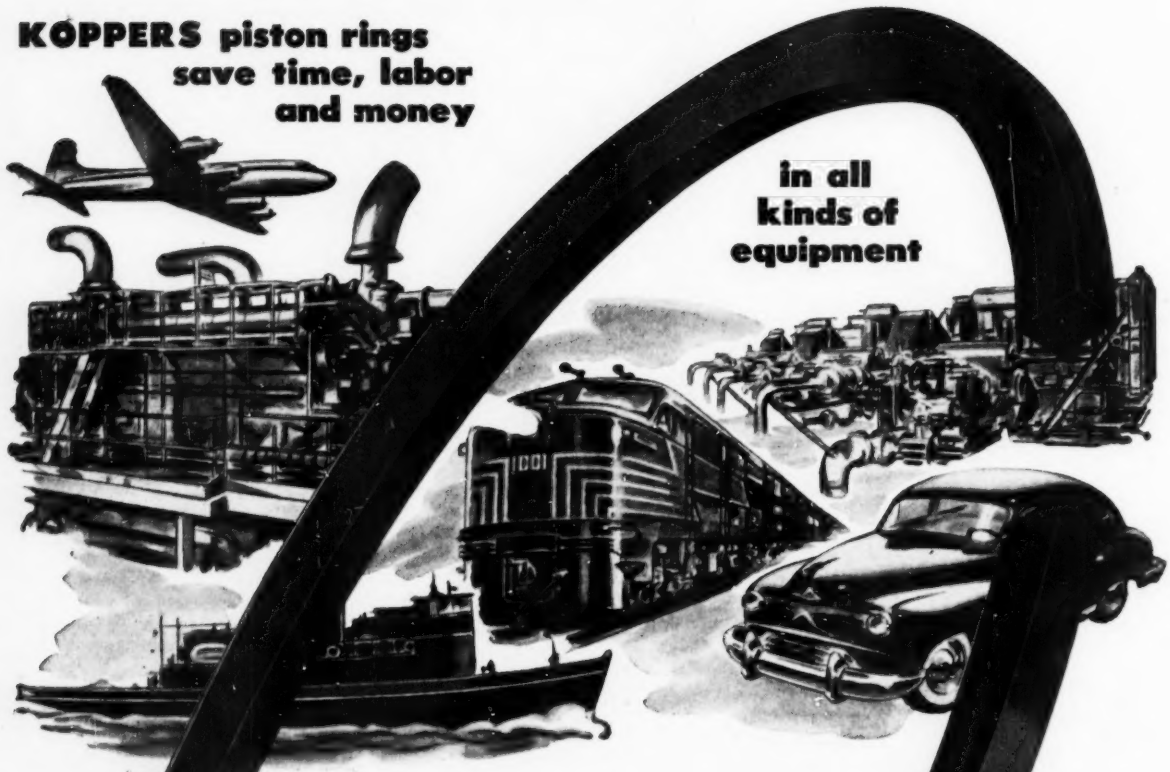
For further information call in a Gulf Lubrication Engineer today. Write, wire, or phone your nearest Gulf office.

Gulf Oil Corporation · Gulf Refining Company
Gulf Building, Pittsburgh 30, Pennsylvania

GULF

**KOPPERS piston rings save time, labor and money**

**in all kinds of equipment**



Railroads, trucks, buses, airplanes, cars, pumps . . . in every conceivable use of piston rings . . . Koppers provides *better* oil control, *more* power, *less* wear, *longer* life for expensive equipment!

Koppers K-Spun Piston Rings, produced by centrifugal casting process, are *100% stronger . . . four times more resistant to combustion shock than ordinary rings! They will not break in installation or for the life of the engine.*

Koppers Porous Chrome* Rings have a porous chrome surface that holds and distributes oil during break-in, quickly wears down to perfectly seated solid chrome that prevents grit and other particles from embedding in the ring surface where they can scratch cylinder walls. Porous Chrome Rings last up to four times as long as other rings, reduce cylinder wear 50% or more. That's why hundreds of companies are reporting amazing savings in equipment and maintenance costs through the use of Koppers Rings. Remember . . . we make rings for any equipment that uses piston rings.

*VAN DER HORST PROCESS

If you have a piston ring problem, why not get the *right* answer from us? Write, wire or phone Koppers Co., Inc., Piston Ring Dept., 1542 Hamburg St., Baltimore 3, Md.

KOPPERS

**KOPPERS**

AMERICAN HAMMERED

**PISTON RINGS**

**SPECIFY: Fast's Couplings . . . Koppers Piston Rings . . . both famous products of the Koppers Co., Inc.**

***ONLY KOPPERS CAN FURNISH K-SPUN OR POROUS CHROME!***

# RECOMMENDED CURE for the high cost of air

## . . . Cooper-Bessemer Motor Driven Compressors

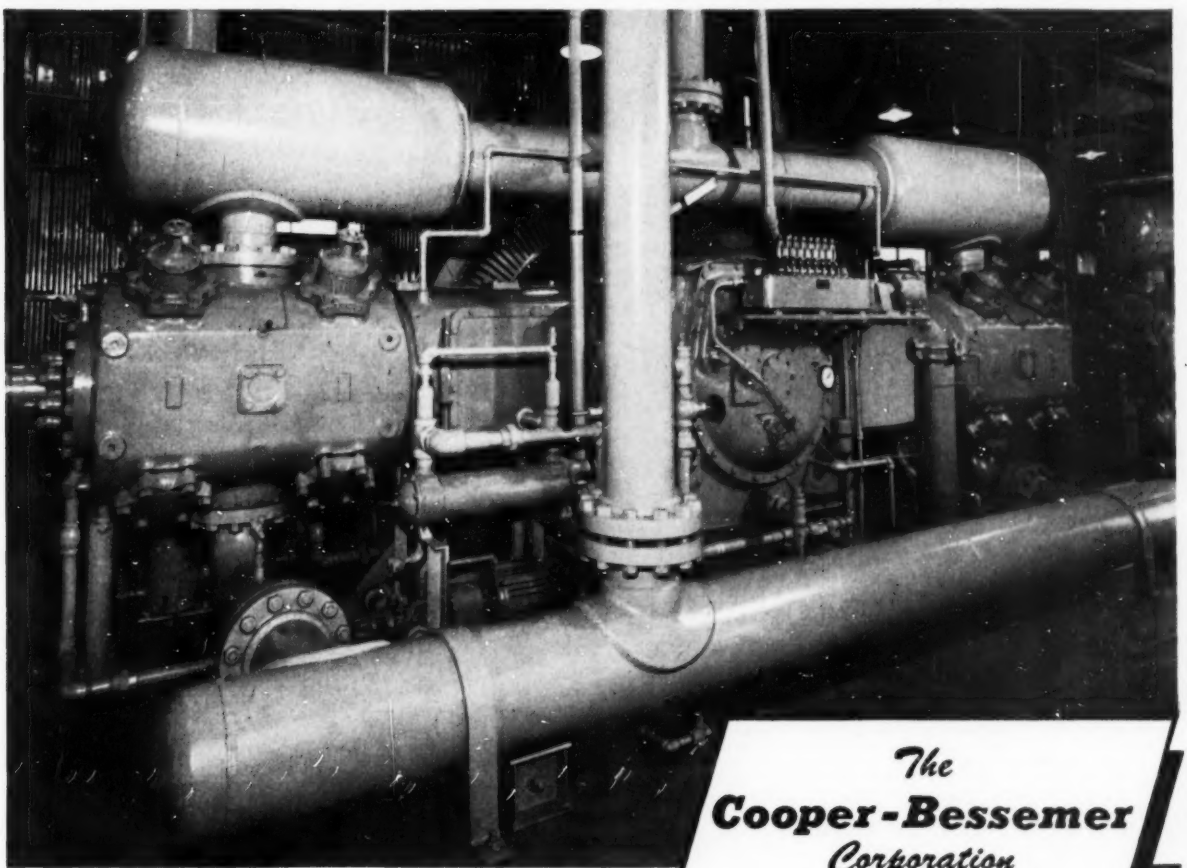
IF your plans call for large scale compressed air on a long-range basis, better have a close look at the savings modern Cooper-Bessemer units offer. Shown above is one of the various types and sizes from 350 to 3000 horsepower.

These motor-driven units, like Cooper-Bessemer engines and engine-driven compressors, are designed and built for years of the hardest service with an absolute minimum of costly down-time. And that's a major gain right there!

Secondly, these Cooper-Bessemers offer you exceptionally high mechanical and volumetric efficiencies, *throughout* an extremely broad demand range. With such flexibility and efficiency you can turn out more air per dollar.

Finally, these units have unmatched compactness among units comparable in flexibility, efficiency and life! Without sacrificing accessibility or ruggedness, you save on space, housing, installation and piping costs.

Yes, if you're interested in compressing air, get full details . . . add up the money-saving facts on these modern units. The nearest Cooper-Bessemer office will be glad to cooperate.



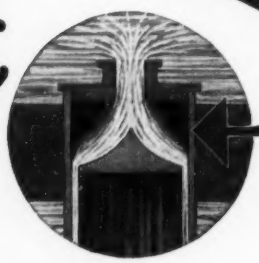
*The* **Cooper-Bessemer** *Corporation*

MOUNT VERNON, OHIO — GROVE CITY, PENNA.

New York Washington, D. C. Bradford, Pa. San Francisco Houston, Dallas Greggton, Pampa and Odessa, Texas Seattle Tulsa Shreveport St. Louis Los Angeles Chicago Caracas, Venezuela Cooper-Bessemer of Canada, Ltd., Halifax, Nova Scotia Gloucester, Mass. Calmes Engineering Co., New Orleans, La.

# Dirty Water can't "Shut-down"...

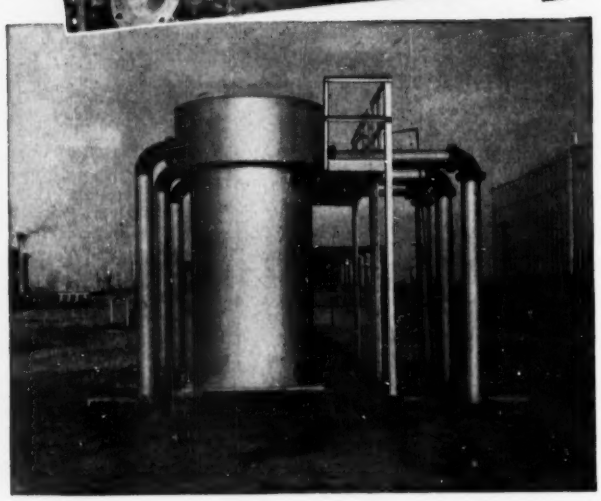
# Vogt



# film type exchangers

## (Condensers—Coolers—Evaporators)

Patent Nos. 1,935,270 - 2,057,597 - 2,424 441



River water, well water or brackish water are all alike to this exchanger *because it can be cleaned* while in operation! The water distributing ferrules need only be removed successively for the cleaning brush or tool whereby the tubes receive additional water which sluices away the dislodged dirt.

Vogt Film Type Exchangers are operating with real economy of first cost, operation and maintenance in power, petroleum, and chemical industries. They serve as Jacket Water Coolers, Feed Water Heaters, Hydrocarbon Evaporators, Sulphuric Acid Coolers, and Sulphur Dioxide Condensers, and can be designed to cool or heat any liquid and to condense or evaporate any fluid.

**TOP:** *Four units at Newton Falls, Ohio Municipal plant cool water for diesel engines and a lubricating oil cooler.*

**BOTTOM:** *Jacket Water Coolers serving engines of 7,300 HP in the compression plant of a Western Oil Refinery.*

[ Bulletin HE-7 describes typical installations of Vogt Film Type exchangers and is available upon request. ]

**HENRY VOGT MACHINE CO., LOUISVILLE, KY.**

Branch Offices: NEW YORK, CHICAGO, CLEVELAND, DALLAS, PHILADELPHIA, ST. LOUIS, CHARLESTON, W. VA.

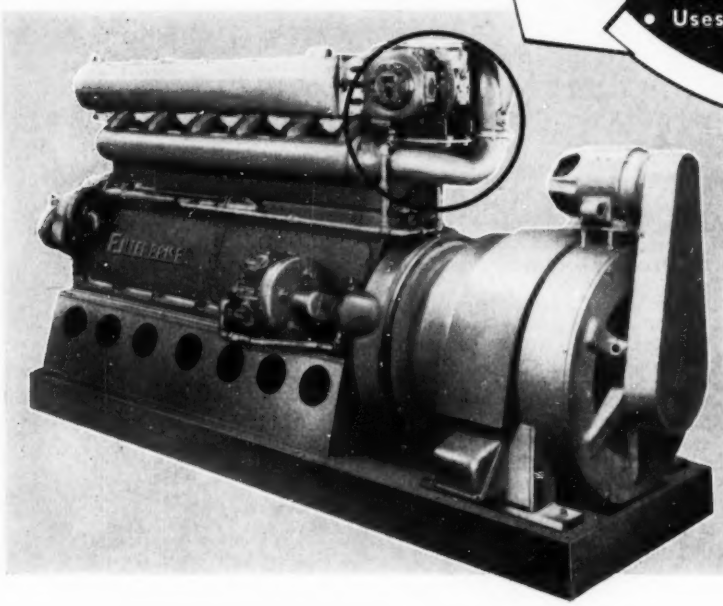
# Now Turbocharged

## TO PRODUCE GREATER HP AT THE SAME MEDIUM SPEEDS

Specifically designed for Turbocharging, the new Enterprise Model M-36 Diesel greatly increases horsepower output at medium speeds—with essentially no increase in engine size or weight over normally-aspirated models. This rugged diesel is built in both stationary and marine models, providing a host of new features and operating economies in heavy-duty, medium speed diesels for continuous service requirements.

**All these advantages of Enterprise Turbocharging – now available in Diesels of the low HP range**

- More power per cubic inch of displacement
- More power per pound of engine weight
- More power per square foot of floor space
- More power per dollar of engine cost
- Greater fuel economy
- Greater overload capacity
- Cleaner engine performance
- Uses low cost heavy fuel



## ENTERPRISE
### MODEL M-36 DIESEL

**TURBOCHARGED RATINGS**
at Sea Level
**275-350 HP**
**at 600-750 RPM**

6 cylinders, 4 cycle,
8" bore x 10" stroke.
Piston displacement 3016 cu. in.

**Enterprise**
DEPENDABLE
**Diesels**

*The Choice of Power Experts*

**ENTERPRISE ENGINE & MACHINERY CO.**
A Subsidiary of General Metals Corporation
18th & Florida Streets, San Francisco 10, California

**MADISON** . . . A CITY

**KIPP** . . . A TRADE NAME AND TRADE MARK

**MADISON-KIPP** . . . A CORPORATION

ESTABLISHED 1898

**MANUFACTURING** . . . DIE CASTINGS AND COMPLETELY MACHINED COMPONENTS, LUBRICATORS • HIGH SPEED AIR GRINDERS

An outstanding feature of the history of Madison-Kipp is the consistency of its services to the same customers year after year for 10, 20, 30 or more.

It has really been a case of being "departmentalized" into the organizations we serve.

This is a type of inter-company relationship that may be especially valuable to you in the near future and for for years to come.

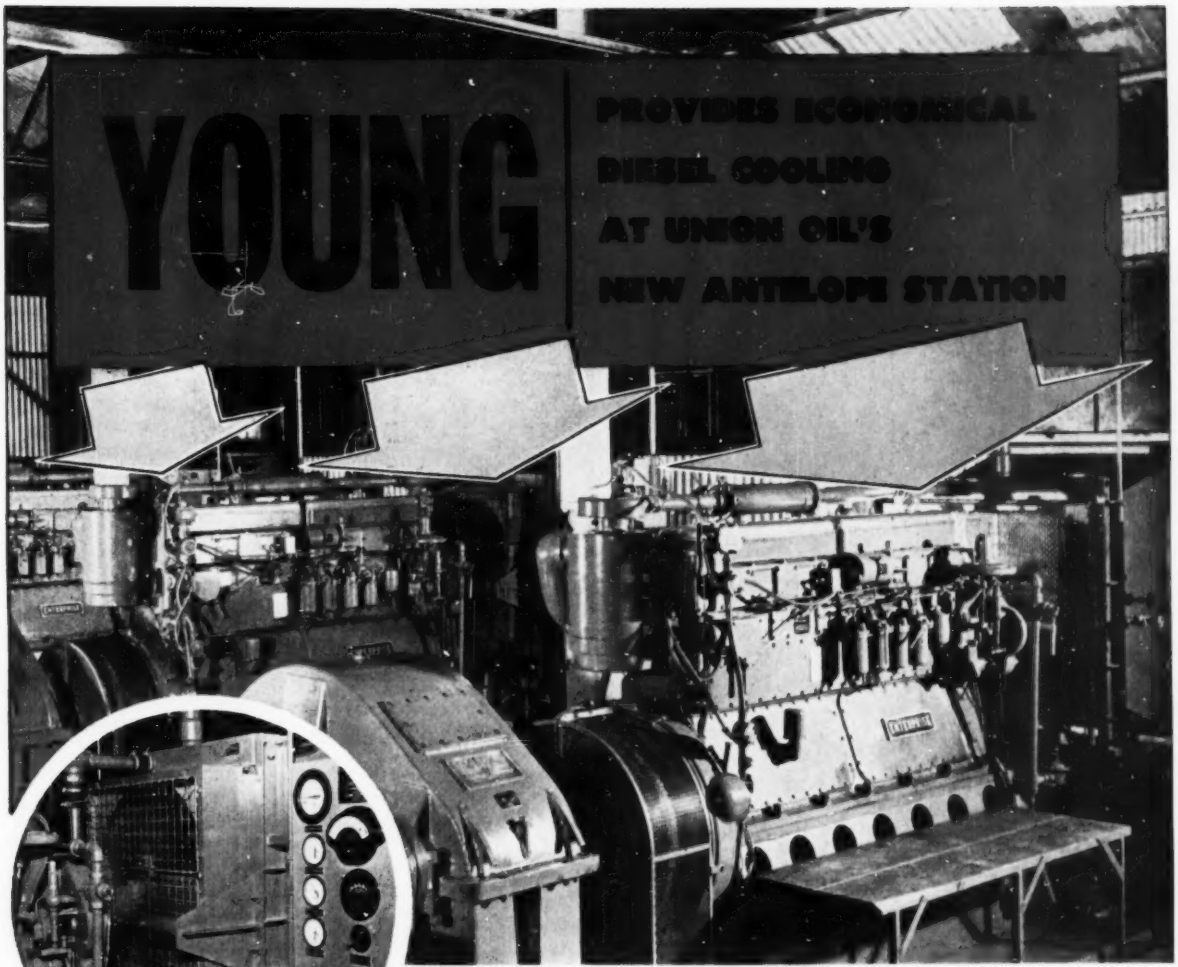
# MADISON-KIPP CORPORATION

205 WAUBESA STREET, MADISON 10, WIS., U.S.A.

ANCIENS ATELIERS GASQUY, 31 Rue du Marais, Brussels, Belgium, sole agents for Belgium, Holland, France, and Switzerland.

WM. COULTHARD & CO. Ltd., Carlisle, England, sole agents for England, most European countries, India, Australia, and New Zealand.

- *Skilled in* DIE CASTING *Mechanics*
- *Experienced in* LUBRICATION *Engineering*
- *Originators of Really High Speed* AIR TOOLS




Increased operating economy and self-sufficiency have been attained at the new Antelope Booster Station of the Union Oil Company. Young "Mono-Weld"* Radiators fit into the picture perfectly. They provide thrifty jacket water cooling for the three Enterprise Diesels installed. Also, the maintenance problem is minimized by the rugged welded steel construction of the Young units (see features at left) capable of withstanding the stresses of mobile equipment application. Your nearest Young Representative will gladly point out the advantages of "Mono-Weld"* Radiators for your applications.

* Trade Mark

**8 REASONS WHY YOUNG "MONO-WELD" RADIATORS GIVE TROUBLE-FREE SERVICE**

1. Fabricated steel top and bottom provide rugged, solid support base for core.
2. Steel channel side members assure rigidity necessary for mobile use.
3. Cores of chosen specification for the particular services are designed, reinforced and built to meet rugged industrial service.
4. Tank structures adaptable to requirements of capacity, size and location of water connections.
5. Cast aluminum air foil or reinforced stamped steel blade type fans available. Offer highest air delivery with lowest power consumption.
6. Fan shrouding specially designed to provide maximum air flow to all areas of the core.
7. Heavy-duty, over-size fan bearing assembly designed by Young to handle all radial and thrust loads.
8. Rigid fan shaft bearing and motor support securely fastened to radiator frame with formed steel reinforced members.

We will be pleased to send you a copy of Young Catalog No. 1651, giving the design and construction details of one-piece and sectional type "Mono-Weld"* Radiators.

# YOUNG

Heat Transfer Products for Automotive and Industrial Applications.

Young Quality

Heating, Cooling, Air Conditioning Products for Home and Industry.

**YOUNG RADIATOR COMPANY**

Dept. 412-B • RACINE, WISCONSIN

Factories at Racine, Wisconsin and Mattoon, Illinois

# DIESEL OPERATORS

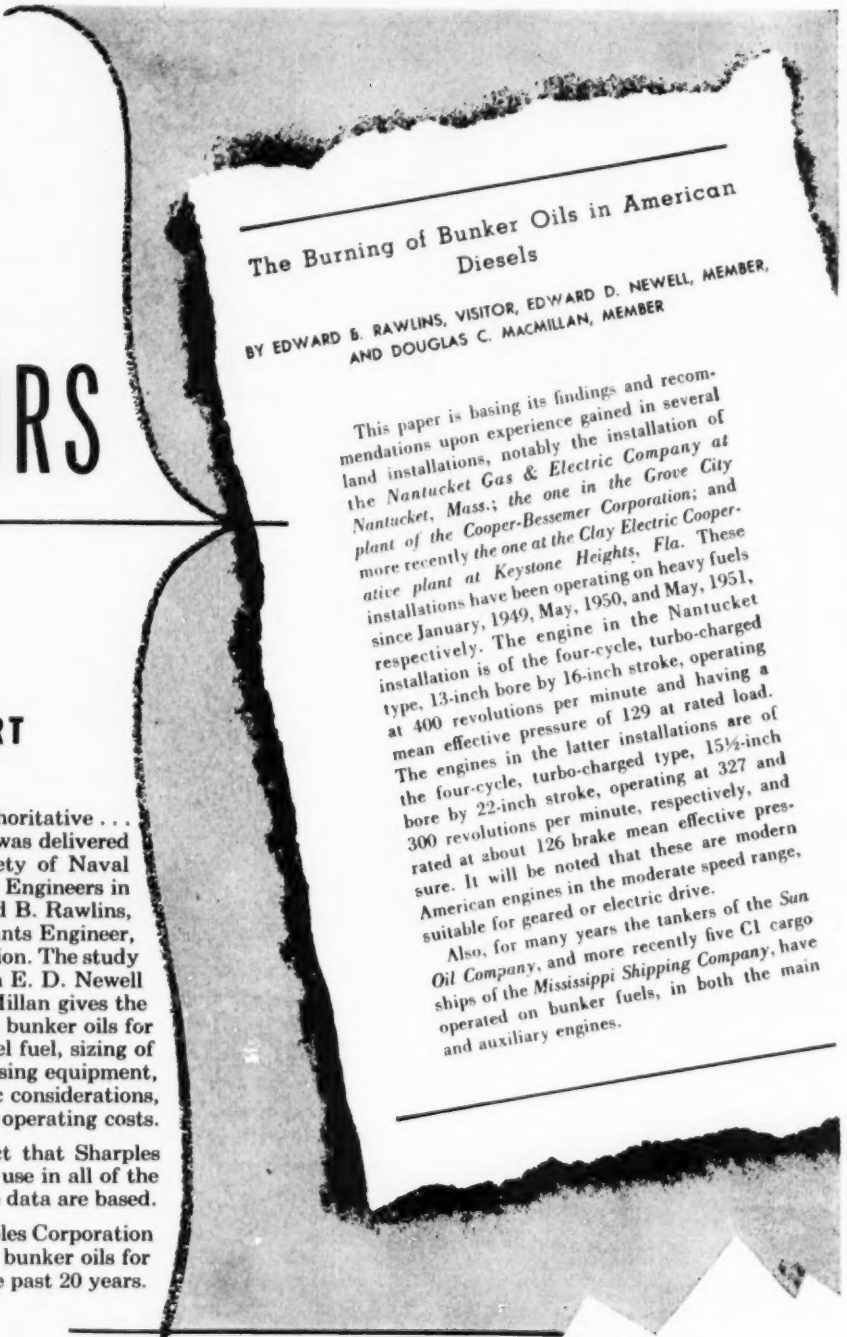
***we will gladly send you a copy of this***

**IMPORTANT REPORT**

Factual, unbiased, authoritative . . . this 16-page report was delivered as a paper before the Society of Naval Architects and Marine Engineers in New York by Edward B. Rawlins, Fuels and Lubricants Engineer, Cooper-Bessemer Corporation. The study made in conjunction with E. D. Newell and D. C. MacMillan gives the method of purifying bunker oils for use as a diesel fuel, sizing of heavy fuel processing equipment, operation, economic considerations, and operating costs.

It is a noteworthy fact that Sharples centrifuges are in use in all of the installations on which the data are based.

Experience of the Sharples Corporation in the purification of bunker oils for diesel fuel extends over the past 20 years.



The Burning of Bunker Oils in American Diesels

BY EDWARD B. RAWLINS, VISITOR, EDWARD D. NEWELL, MEMBER, AND DOUGLAS C. MACMILLAN, MEMBER

This paper is basing its findings and recommendations upon experience gained in several land installations, notably the installation of the *Nantucket Gas & Electric Company at Nantucket, Mass.*; *the one in the Grove City plant of the Cooper-Bessemer Corporation*; and more recently *the one at the Clay Electric Cooperative plant at Keystone Heights, Fla.* These installations have been operating on heavy fuels since January, 1949, May, 1950, and May, 1951, respectively. The engine in the Nantucket installation is of the four-cycle, turbo-charged type, 13-inch bore by 16-inch stroke, operating at 400 revolutions per minute and having a mean effective pressure of 129 at rated load. The engines in the latter installations are of the four-cycle, turbo-charged type, 15½-inch bore by 22-inch stroke, operating at 327 and 300 revolutions per minute, respectively, and rated at about 126 brake mean effective pressure. It will be noted that these are modern American engines in the moderate speed range, suitable for geared or electric drive.

Also, for many years the tankers of the *Sun Oil Company*, and more recently five C1 cargo ships of the *Mississippi Shipping Company*, have operated on bunker fuels, in both the main and auxiliary engines.

***For your copy, just write***

# SHARPLES

THE SHARPLES CORPORATION • 2300 WESTMORELAND STREET, PHILADELPHIA 40, PENNA.

NEW YORK • BOSTON • PITTSBURGH • CLEVELAND • DETROIT • CHICAGO • NEW ORLEANS • SEATTLE • LOS ANGELES • SAN FRANCISCO • HOUSTON

# Big Mileage from Small Doses!

**Only one tablespoon of fuel oil in a GM Diesel locomotive moves a ton of freight 2½ miles**

GM Diesel locomotives haul more than one-third of the freight on American railroads, yet they use 30% *less* total fuel than oil-burning steam locomotives that do only one-fourth as much work.

**To conserve fuel America needs more Diesels!**

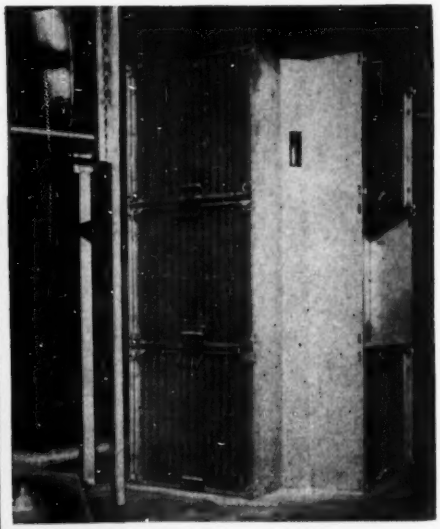
ELECTRO-MOTIVE DIVISION
GENERAL MOTORS

LA GRANGE, ILLINOIS——*In Canada* GENERAL MOTORS DIESEL, LTD., LONDON, ONTARIO

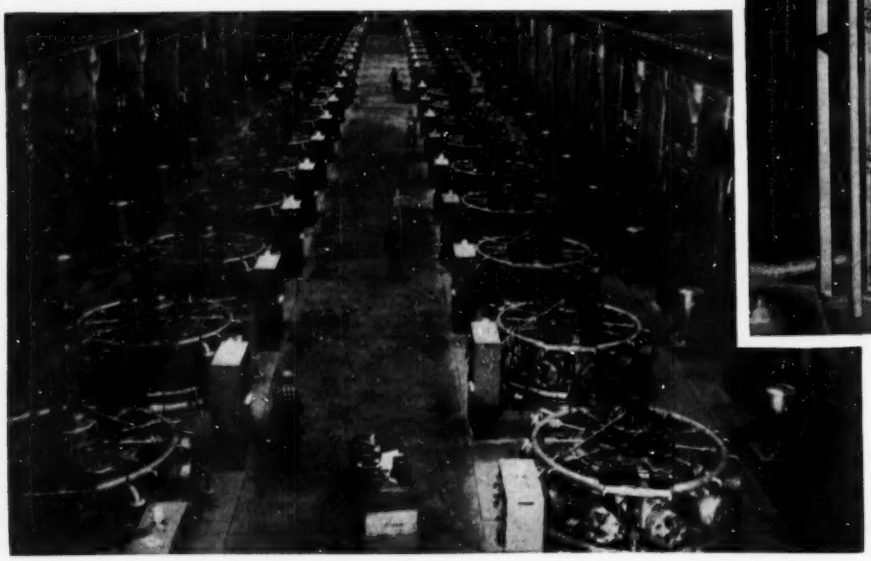
*If you are interested in the conservation of fuel by Diesel locomotives, write Electro-Motive Division for a recent study.*

# KAISER ALUMINUM

## Uses AAF Filters As "Power Protection"



▲ 8-Unit Type PL-H Amer-Aire Intake Filter, one of which serves each of the eighty engines.



◀ View of main power plant showing portion of the 80 Nordberg Radial-Type Gas Engines.

## New Chalmette, La., Reduction Plant Goes into Production with Clean Air Assured for 80 Radial-Type Gas Engines

"Heart" of the Kaiser Aluminum & Chemical Corporation's new aluminum reduction plant is this power station where 80 Nordberg Radial-Type Gas Engines drive a like number of generators. Supplying clean air for these engines imposes exacting demands on the filters. The very handling of the fine alumina powder creates a dust problem of major proportions. Added to this, you have a climate where excessive moisture is most common.

The filters selected for the job—eighty 8-unit Type PL-H Amer-Aire Intake Filters. This dry-type filter, featuring disposable Airmat filtering media, is particularly effective in cleaning air containing both excessive moisture and a high volume of fine dust.

This is the second large Gulf Coast aluminum plant where Amer-Aire Intake Filters have been installed on the engines. The reason—a complete line of filters to meet every need, whose effective design and performance have been proved in fact as well as theory. A mighty good reason why you should specify the "power protection" of AAF Amer-Aire Intake Filters.

Today's Best Buy is Better Air!

AAF

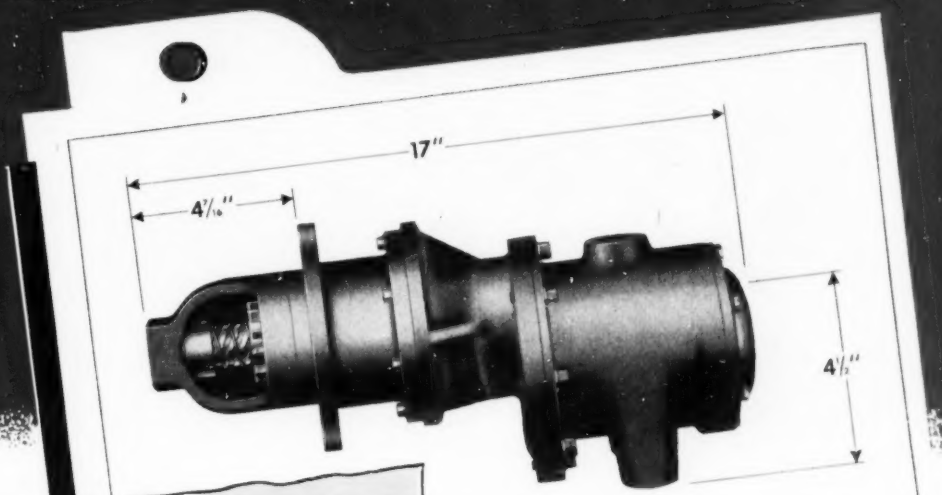
**American Air Filter**

COMPANY, INC.

445 Central Avenue, Louisville 8, Kentucky • American Air Filter of Canada, Ltd., Montreal, P. Q.

# NEW AIR CRANKING MOTOR

## *Eliminates Batteries*




**INGERSOLL-RAND ANNOUNCES A COMPLETE LINE OF NEW AIR CRANKING MOTORS FOR ENGINE STARTING SERVICE.**

Reliable and economical engine starting is now *yours* with powerful I-R Air Cranking Motors. Easy to install, these compact motors eliminate the need of generators, electrical controls and banks of storage batteries. Nine standard sizes, designed for use on over 150 commercial engines up to 3520 cubic inch displacement, are available to meet your individual requirements.

A powerful Multi-Vane air motor starts the engine through a standard Bendix drive, that matches the performance characteristics of the air motor. Air Cranking Motors cannot be burned out, or damaged by stalling. Their use also eliminates expensive repairs frequently caused by climatic conditions that deteriorate the insulation on electric motors. In many instances the yearly replacement cost of storage batteries pays the initial cost of an Air Cranking Motor.

In an emergency, a small bottle of compressed air or carbon dioxide piped into the motor may be used for starting purposes.

I-R Air Cranking Motors may be readily installed on your present engine by your own mechanics or your engine distributor. In mounting, the Bendix housing can be rotated on the gear case, and the gear case rotated on the motor housing to clear projections on the engine. Any mechanic familiar with maintenance of internal combusion engines can readily service an I-R Cranking Motor.

Fill out the coupon and mail it today for complete information on remarkable new trouble-free, low-cost, engine starting.

**Ingersoll-Rand**
11 BROADWAY, NEW YORK 4, N. Y.

626-B

Dept. B Ingersoll-Rand Company, 11 Broadway, New York 4, N. Y.

*Please send me complete details of your new Air Cranking Motors.*

Name_____ ☐ Engine Distributor

Address_____ ☐ Engine User

Make of engine_____ Model_____ Cu. in. of displacement_____

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One of the two engine rooms of the Kaiser Chalmette Aluminum Plant seen through a typical Louisiana framing of Spanish moss.


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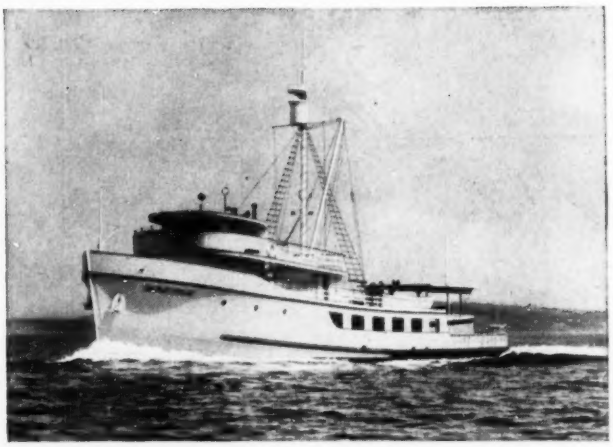
# STAR PERFORMER

## in *South Pacific*

## and

## OLD MAN RIVER



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Editorial:

# Scrap is Imperative

As a "hard goods" industry we must have steel to maintain production. It is all very well to talk of essentiality; that NPA must allot the required amounts; and also to try the appeals route for greater allotments. The simple fact is that these actions are futile unless the material is there for allocation. You can't give out what you don't have.

The basic problem is to increase the supply. Then we can justifiably scream if we feel that maldistribution is taking place. It is not just the job of the NPA and the steel companies; in our intergrated economy we must all pitch in. How? Right now, by helping to get scrap to the mills.

The criticalness of the situation is underlined by recent advice that three open hearth furnaces of U. S. Steel at Gray, Indiana were shutdown to conserve seriously depleted inventories of iron and steel scrap. Steel officials warn that there is prospect of additional closing unless scrap supplies are immediately expanded.

In his Fourth Quarterly Report to the President, Defense Mobilization Director Wilson has the following to say: "To support steel production at capacity, 3 million tons of scrap a month must be supplied to the steel mills. Although this level was not met in 1951, it was exceeded by a substantial margin in 1950. It is clearly a feasible goal for the coming year." Feasible, yes, if industry cooperates.

For those who may not be aware of the role of scrap in steel production, we would like to give a thumbnail sketch. Nine-tenths of the steel produced in this country is made in open-hearth furnaces, the rest being made in Bessemer converters or electric furnaces. The charge for the open-hearth furnaces is from 52 to 54 per cent pig iron with the balance, scrap. Bessemer converters use practically no scrap and electric furnaces practically all scrap.

Let's talk about the open-hearth furnaces for a moment. Pig iron is more expensive than scrap because it is costly to refine. A ton of coke, a half ton of limestone and two tons of iron ore are necessary to produce a ton of pig iron. In making steel, use of high percentages of scrap (already refined) correspondingly lowers the amount of pig iron and limestone required and reduces processing time.

One ton of industry scrap enables production of four tons of steel. Percentages wrong? No, there are two kinds of scrap; the industrial scrap and "home" scrap. The latter results from the processing of ingots in the mills; croppings of ingots, billets and blooms or slabs.

So far we have talked about iron and steel scrap. It is of equal importance that the need for non-ferrous scrap be equally recognized. Copper, brass, bronze, aluminum, lead and zinc are at the top of the list. All are used by our industry and are, therefore, of vital interest to us. Early emphasis on the steel scrap shortage has tended to over-shadow subsequent stress on the non-ferrous situation, but this does not make it any less critical and vital.

There is only one way to insure that the flow of scrap generated in our industry finds its way back to the mills—organization. Harvey Hill of DEMA has already been active along these lines. Thorough and sustained effort requires that each organization set up a definite and continuing program to track down and dispose of dormant scrap as well as that normal to production.

Top management should start the ball rolling by delegating authority as a definite function to an individual or a committee to see that the scrap moves. Suggested functions should include:

1. Search all plants and properties, regardless of size, for dormant scrap.
2. Survey potential wrecking and dismantling projects yielding scrap.
3. Quickly dispose of all production and dormant scrap.

Not only is such a program a timely and patriotic thing to do, it is good business: Scrap collection placed on a "housekeeping" basis with periodic—say, monthly—surveys will have many benefits attendant to the major one of getting scrap moving. First, there is the income. Secondly, realistic evaluation of questionable standby machinery, etc., could reduce taxes through inventory write-offs. Thirdly, such clean-ups will very probably improve safety conditions, giving lower insurance rates, and clear valuable space. There are a lot more, but you get the idea, we are sure.

No doubt there are some members of our industry having good programs of which they are proud. Let's hear about them. We would like to give them the publicity that they deserve. To those who may not have formalized their programs, we suggest that they get busy. Where else can you get a four to one payoff!

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# + HIGHLIGHTS +

● Three major natural gas pipeline projects, with a total estimated construction cost of $255,855,000 have been given priorities assistance for 143,150 ton of line pipe.

● Tractors are helping missionaries in Africa in the age-old fight against polygamy. A bishop tells of one old chief who exclaimed, "Why, this machine can do far more work than ten wives", and promptly decided that henceforth one wife would be enough.

● G-E recently reported conservation of 10 million lb. of copper in 1951 through substitution. They claim that quality did not suffer. Most substitutions were in consumer goods leaving copper for more vital uses.

● At the present time there are 281,623 miles of pipeline in the United States, carrying crude oil, natural gas and petroleum products—more than the mileage of all Class I railways in the country.

● Volume of national output increased about 8 per cent in 1951 as against 1950 and was the highest ever. Recent DIESEL POWER survey indicates that the diesel industry shared in this. One engine company showed a 25 per cent increase and perhaps others, unreported, are higher.

● Railroads may look forward to another year (1952) of good traffic volume, according to Gustav Metzman, president, N. Y. Central. Whether the year will be financially satisfactory will largely depend on authority to make rate adjustments. Imagine conditions if the railroads did not have the economy of diesel-electrics to help finances.

● Railroads in the United States used 5,769,000 tons less coal in 1951 than in 1950 due to the dieselization program.

● Drop in consumer demand for nonferrous metals abroad is beginning to be reflected in prices. First cutback was in the price of lead with zinc and copper expected to soon follow.

● A $6,000,000 order for 27 diesel-electric locomotives was placed recently with the International General Electric Co. by the Indonesia State Railways. Locomotives are of 1600 hp. and will be used for both freight and passenger service.

● Senators Johnson and Bricker of Ohio have introduced a bill for uniform regulation of truck sizes and loads in interstate commerce. The bill would limit loads to 18,000 pounds per axle except in states where heavier cargos are specifically approved.

● Montreal Locomotive Works has received an order for 48 road locomotives of 1600 hp. each from Central Railway of Brazil, with delivery to start in the third quarter of this year. It has just completed an order for 20 1600-hp. engines for New South Wales.

● Copper supply should improve materially in the latter half of 1952. Cornelius F. Kelley, chairman of Anaconda Copper Mining Co., recently said that domestic mine production was averaging 90,000 ton per month with 35,000 ton available from foreign sources. This optimistic note contrasts sharply with NPA outlook but, if right, should greatly improve diesel manufacturing prospects.

● A new drilling record was set recently by a drill crew in South Louisiana when they made 2575 feet of hole in eight hours. That is averaging 322 ft. per hour—some going.

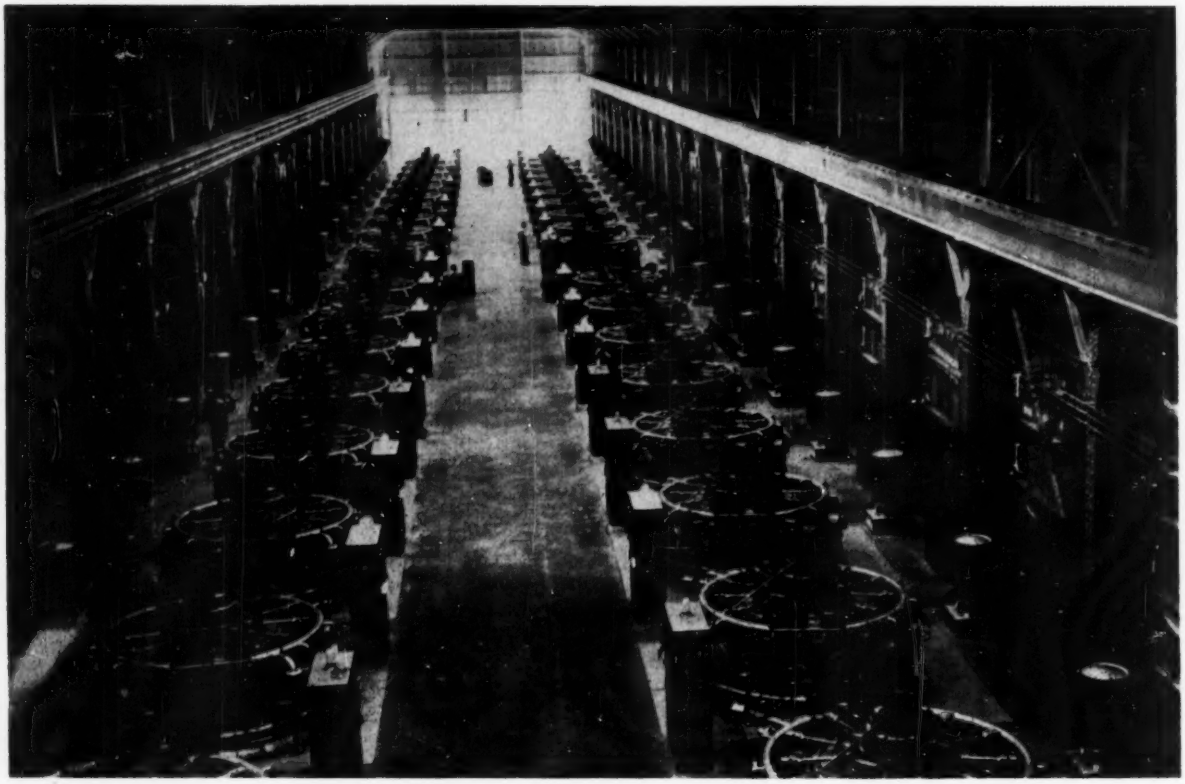
● To relieve the power shortage in the Northwest, President Truman recently endorsed a bill pending in Congress for construction of five small and eight large fuel-burning electric plants. Hope some are diesel.

● An indication of the tightness of the machine tool situation is shown by a report from the Newport News Shipbuilding Co. Unable to buy a large boring mill, they are now building one in their own shops.

● A government release states "When completed the (pipeline) projects now under way will relieve the present burden on the nation's over-taxed rail system". Wonder just how they mean that "over-taxed" business.

● Possible sources of steel scrap being considered are old, disused trolley and railroad tracks around the country. High costs involved in tearing up tracks, pavement replacement, etc., will bring scrap cost to $85.00 per ton. Shows how critical the scrap really is. Our industry, along with many others, must have steel.

● Ways to overcome acute shortages of scientific manpower are suggested in a series of studies prepared for the Navy on how to improve the selection, training, and utilization of scientists. Many of these reports are in the December issue of "Bibliography of Technical Reports", issued by Office of Technical Services, Dept. of Commerce.



# Kaiser's Chalmette Aluminum Plant

***Highlighting features of the two gas engine-powered potlines that–***

- ***Went into operation within ten months after start of construction.***
- ***Will produce 100 million lb. of critically needed aluminum—now***
- ***And will produce it at a most economical cost for power.***

FIRST of the plants to go into production under the nation's aluminum expansion program is the Chalmette, Louisiana, reduction plant of the Kaiser Aluminum and Chemical Corporation. When fully completed, the plant will have eight potlines with an annual production of 400 million lb. of aluminum.

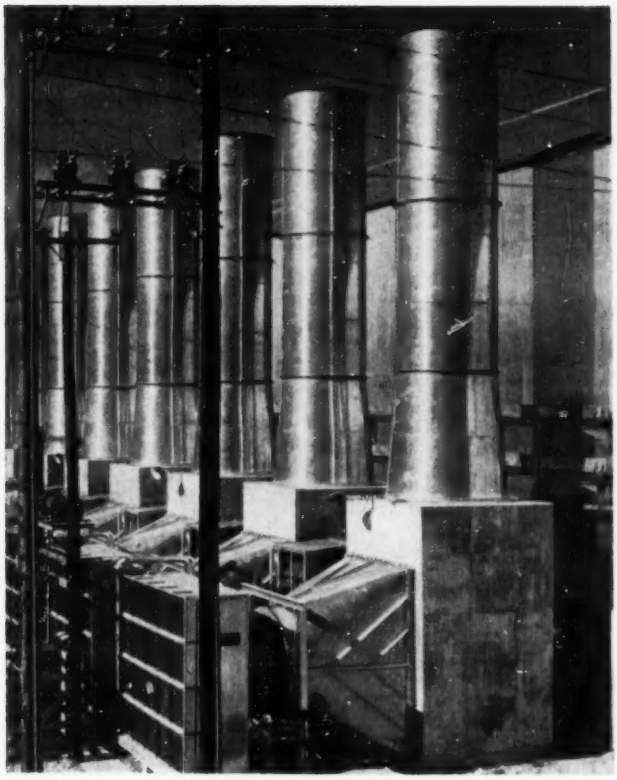
Eighty Nordberg gas-burning radial engines supply approximately 132,000 hp. for two of the potlines. The balance will be steam powered. Significantly, the two internal combustion engine powered potlines went into operation on December 11, 1951, less than ten months after construction was started.

Thus, 100 million lb. of aluminum per year will immediately start flowing into the aluminum supply, *now*, at a time when it is critically needed for defense and defense-supporting production.

**The scope of operations is tremendous in view of the huge production job.**

A 280-acre site bordering the Mississippi River at Chalmette was acquired and eventually, under present plans, will contain some 75 buildings with nearly 35 acres of floor space, about 3½ miles of rail trackage, 60,000 cu. yds. of roadways, and innumerable items of equipment.

Equally impressive are some of the requirement figures for construction and future operation. Approximately $150,000,000 worth of concrete, steel, aluminum, lumber and other building materials, machinery and labor will be expended. Annual requirements for raw materials will include 530,000 ton of alumina, carbon and other chemi-



*At far left is view down center of one engine room. At left, typical stack arrangement is seen. Lube and water coolers are at left. Between stacks are tops of building air washers.*

cals, 50 billion cu. ft. of natural gas and 50 billion gal. of water. The last item is required principally for operation of the steam plant.

There will be 16 potrooms, two for each potline, lined up side-by-side. Each "room" measures 960 ft. long and 59 ft. wide. A potline consists of 144 Soderberg pots or 72 per room. Each of the electrolytic cells produces aluminum at the rate of 40 lb. per hr.

A "Metal Service" building traverses one end of the potrooms and provides facilities for pouring the molten aluminum into pigs, their storage and shipment. This building measures 1650 ft. long and 60 ft. wide for most of its length. At one end the width is nearly doubled to house holding furnaces for molten metal and casting equipment.

**Nordberg radial engines were selected for the 24-hr. per day job of providing power for the first two potlines to go into operation.**

No new-comers to this type of operation, these engines will form Louisiana's largest internal combustion engine power plant. Each of the units has 11 cylinders equally spaced in a radial plane around a vertical shaft. The bore is 14 in. and the stroke, 16 in. Units of this type are built as diesel, dual-fuel, or spark ignition gas engines. As there is an abundance of low cost natural gas in the area, it was economic to select the latter execution, incorporating an advanced design spark ignition system.

A pulse generator, high tension dual ignition distributor, two high tension coils and two rectifiers provide ignition for each engine. Other major engine equipment includes motor-driven mechanical lubricators for cylinder lubrication and a hydraulic governor.

For this application the engines are rated 1650 hp. each and are coupled on a vertical axis to General Electric 1290-kw., 700-volt dc. generators. This arrangement makes maximum use of vertical space thereby reducing the floor space requirements. The compact cylinder arrangement also furthers this idea, taking up only about half the room necessary for equivalent conventional engines, and has the added advantage of permitting shipment of the engines to the plant as complete units.

The general engine design, consecutive cylinder firing order, and the convergence of combustion pressures and inertia forces at a focal point on the crankshaft axis produce almost perfect balance and freedom from vibration. This permits the use of a simple, inexpensive foundation, down to 20 per cent of usual requirements. The importance of this fact is emphasized in this case since one of the major problems confronting Kaiser Engineers was that of drainage and foundations. The water level in the area is only a few inches under the ground surface.

All of these factors combine to permit the engines to be divided into two groups of 40 with each group compactly housed in a steel frame building, covered with corrugated aluminum, measuring 432-ft. long, 55-ft. wide and 58-ft. high.

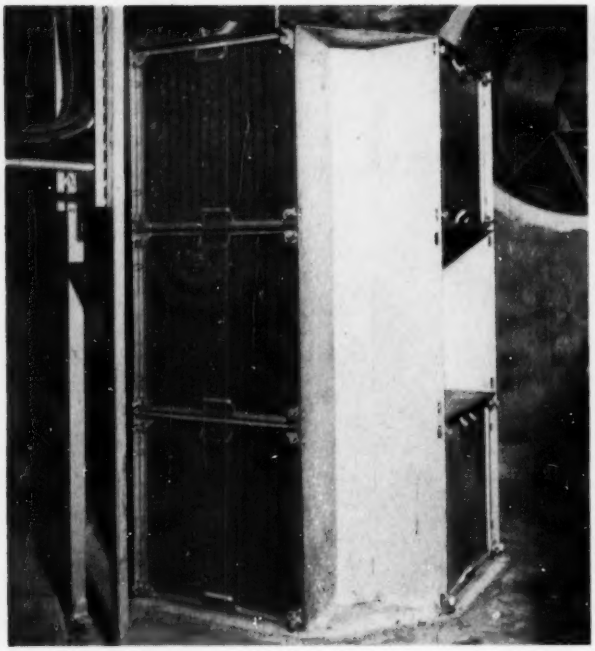
Normally, 37 engines in each building will be in operation with three on stand-by. The proportion of the load carried by each group can be varied, however, as a control house between the buildings is the focal point of the control system. Here, the output voltage is controlled and operation of all the engines observed and governed.

Each engine-generator requires 160-hp. in auxiliary motors for its operation. In former installations this was provided from slip rings on the rotor of the generator, making each unit self-sufficient. About 8 per cent of the power at 25 cycles is brought out. In this case the ac. power is supplied by the steam plant through load center sub-stations in the conventional manner for industrial plant loads. Correspondingly, the dc. generator output for potline use can be increased.

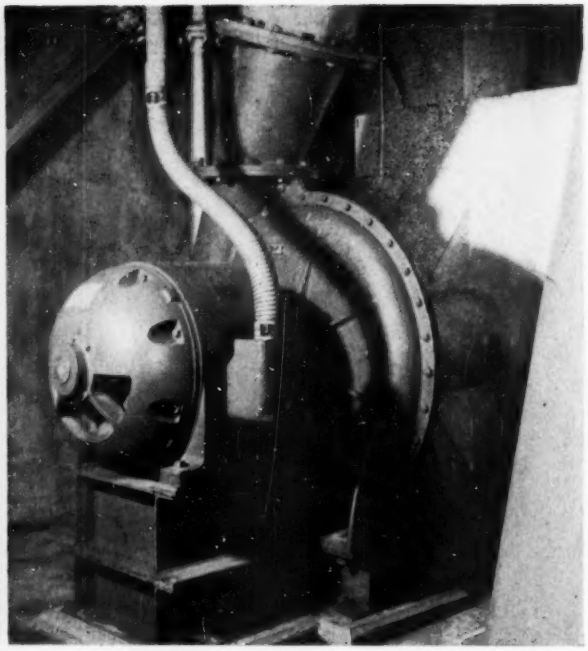
**Jacket water and lube oil cooling takes place in a closed system employing dry-type fluid coolers.**

Each engine rejects nearly 3,000,000 Btu. per hr. to the jacket water and lube oil which must be removed in its individual cooling system. Basically, this consists of two fin and tube coil circuits with a propeller fan to draw air over the coils.

Three-row coils are used and air at up to 100° F temperatures is forced over them. It passes over the oil cir-



*Panel type air filters for scavenging air. Connection to scavenging blower can be seen at left. At top right is one of the building air blowers that draws air through water washers.*



*A scavenging air blower supplying washed and filtered air to an engine. In former installations, power was taken from generator to run blower. Here, ac. power from steam plant is used.*

cuit first, cooling the oil from 147° F to 127° F. Jacket water is similarly cooled from 155° F to 145° F, a removal of about 2,030,000 Btu. per hr.

An 84-in., 6-bladed fan for each cooling unit is driven by a 2-speed 25-hp. (at top speed) motor. At this rating the speed is 720 rpm. and the volume displaced, 43,000 cfm. When ambient temperatures drop, the motor automatically shifts to its second speed of 360 rpm. This results in a 39,000 cfm. output and a considerable saving in horsepower requirements. Additionally, fan blade pitch is capable of adjustment to meet seasonal temperature requirements.

After passing over the cooling surfaces, the air enters a concrete cubical from which it discharges vertically through the aluminum exhaust stacks. The engine exhaust is also conducted to this cubical and deflected up the stack. Due to the proximity of residential areas, silencing snubbers were placed in the exhaust piping.

**Scavenging air is both washed and filtered before entering the engines. It is taken from inside the buildings.**

A fresh air supply for the engine rooms is provided by 80 tubeaxial fans, 40 per building. Each is a 54-in. unit with a 7½-hp. motor driving the propeller fan. Ahead of each fan is a brazed aluminum air washer. A water spray picks up 99 per cent of the fine air-borne particles, such as alumina dust, during the flow through the washer. Baffles prevent excessive water carry-over.

The closed spray system also provides an evaporative cooling effect. Entering air at 100° F, dry bulb, is cooled to approximately 78.5° F, dry bulb. The wet bulb temperature of about 75° F does not change substantially due to the lowered temperature and possible increased humidity of the washed air.

High pressure scavenging blowers, driven by 125-hp., 3600 rpm. motors, supply air to the engines. The washed air within the buildings is used. Dry type filters are installed at the blower intakes and in addition to filtration, they serve the useful function of eliminating some of the excessive moisture in the air. High humidity is typical of the climate in the area and some additional moisture may be picked up in the washers.

Each of the building air fans provides 35,000 cfm. of filtered ventilation to compensate for the 30,400 cfm. used and exhausted by each of the engines and for generator cooling, exhaust fans, etc. Thus a slight positive pressure is maintained in the engine room.

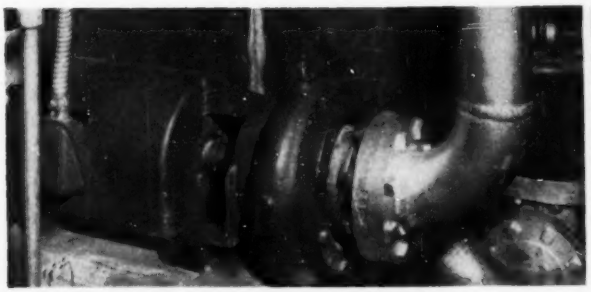
**The lubricating oil system was designed for functional efficiency and ease of handling.**

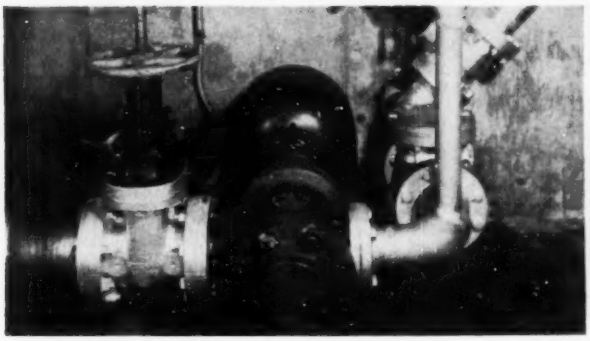
A pair of 26,000 gal. storage tanks are located outside the buildings. Inside of each building are four auxiliary storage tanks each of 5000-gal. capacity—two for clean and two for used oil. On the lower level, a 750-gal. sump tank is provided for each engine.

This is the working oil for each engine and an adequate supply is assured by 165-gpm. pumps driven by 10-hp. motors. Each of these systems is provided with a purifier working on a bypass basis. A system, common to all the engine of a building, is provided for batch purification of dirty oil.

When necessary, the sump tanks can be drained and the oil pumped to the dirty oil tanks at the end of the building. It is allowed to settle for a reasonable length of time and then put through two centrifuges after which it returns to the clean oil tanks for service.

The arrangement of piping and





*At top is jacket water circulating pump as provide for each engine. Below is the lube oil circulating pump taking its suction from the aluminum sump tank.*

*One of the control cubicles duplicated for each of the 80 engines. At top right is the Pyrotac that continuously monitors the cylinder exhaust temperatures.*

pumps facilitates transfer of the oil as desired. Included in the system are provisions for transfer of oil from the main supply tanks to the clean oil tanks in the buildings.

**Natural gas from nearby fields is used for fuel.**

Gas is delivered by the United Gas Pipe Line Company through a 16-in. pipeline running to the plant station. Here, it is scrubbed and metered. It is also necessary to reduce the pressure prior to distribution to the power plants.

The gas is supplied to the engines from headers at each side of the center aisle. The pressure is further reduced in the branch lines to meet the engine requirements.

**Automatic control of the engines has been provided to a maximum practical degree.**

In addition to the central control station mentioned, each engine has its own control cubical including engine starting relays, engine equipment and protective equipment. Provision is made for automatic engine shut-off in the event of high water, exhaust or generator temperatures, low oil pressure or loss of auxiliary power.

A feature of each instrument panel is the use of a Pyrotac, a motor-driven, continuously indicating pyrometer that monitors cylinder exhaust temperatures. In addition to providing easy and fairly distant visual checking, it incorporates a sensitive relay that is tripped, shutting down the engine, should any cylinder reach a predetermined high level.

Engines are electrically started by energizing the main generator and using it as a motor. In general operating procedure, the engine cannot be started until all of the accessory units are in full operation. White lights on the instrument panel indicating that the scavenging blower, air intake fan, cooler fans and other accessory equipment are in operation must be seen before the starting button is pressed.

Due to the many automatic features, the engine room operating crew can be small and efficiently organized. There is one shift foreman for the two engine rooms, a control operator in the master control room and one man on each of the two levels in each engine room.

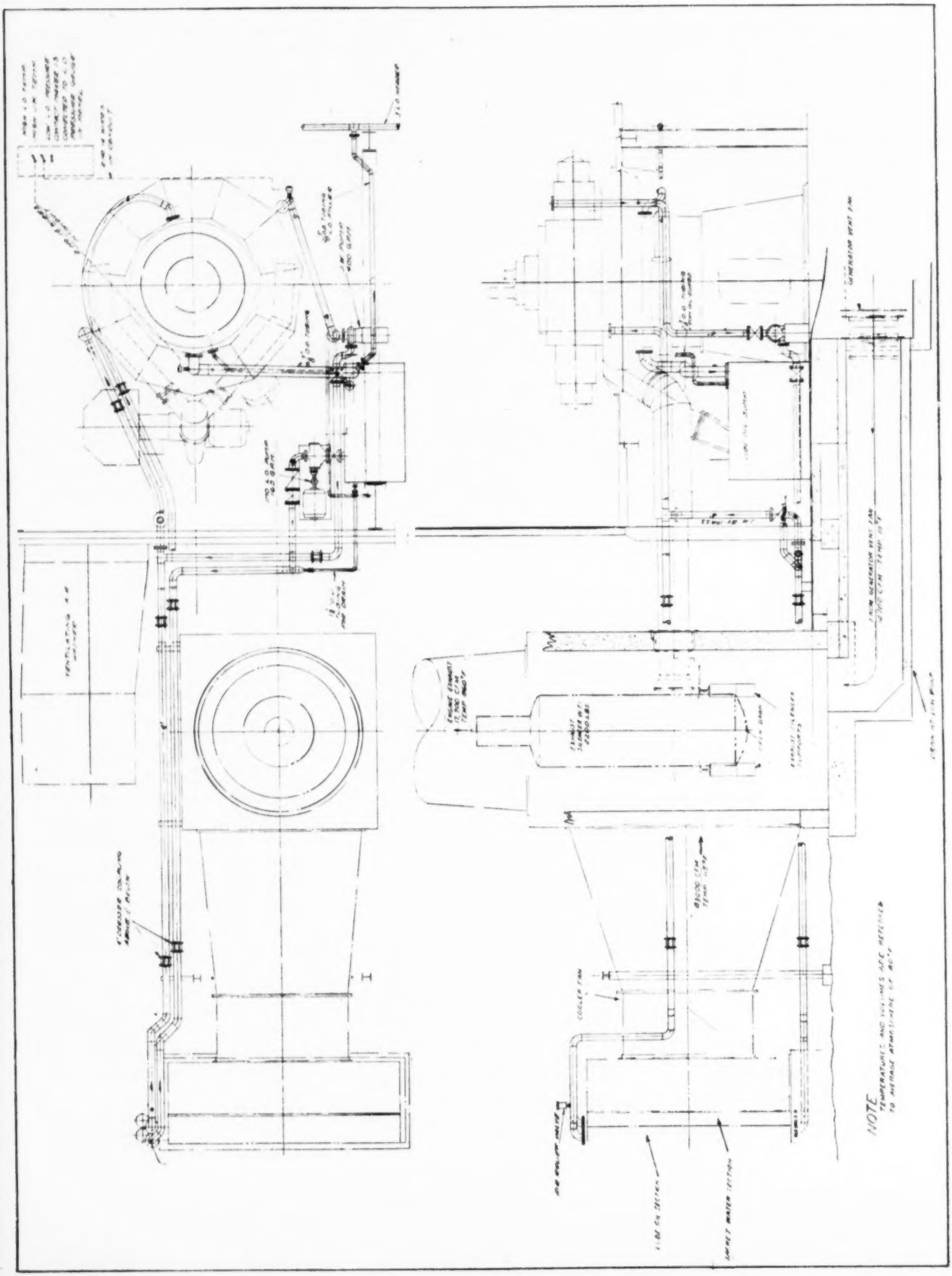
**More scrap means more steel.**
**Turn yours in today!**

**Kaiser Engineers felt that best overall power production costs could be realized by a combination gas engine-powered and steam turbo-generator plant.**

Fifteen boilers and 16 turbo-generators will comprise the completed steam plant. Potline power will be provided by 14 turbo-generators of 25,000 kw. capacity each. Two 11,250 kw. turbo-generators will provide approximately 9600 kw. for auxiliary power in the gas engine plant. The balance will be used for overall plant services plus the steam plant requirements including the huge water pumping load.

Some comparative cost estimates are contained in a paper by George Scheer, chief consulting electrical engineer of Kaiser Engineers, presented to the American Institute of Electrical Engineers.

Mr. Scheer points out that on the basis of 10 cent per 1000 cu. ft. gas, now available, that power generation for 2 mills is a practical reality. Capital costs will add from 1 to 1½ mills. Since plant usage is never 100 per cent, an additional increment must be added. Thus, power, including all costs,


NOTE

can be made for between 3 to 4 mills.

The engine builder's heat rate is 12,000 Btu. per kw. hr. on the self-sufficient installations having a 1170 kw. net output. Corrected on the basis of the 1290 kw. net ratings, this would be 11,000 Btu. per kw. hr. with 120 kw. supplied each engine from an external source.

In calculating the cost of gas consumption, the low heat value must be used. Texas gas, in general, has a high heat value of 1000 Btu. and a low value of 910. The 90 Btu. difference essentially represents the heat required to vaporize the $H_2O$ formed. Boiler efficiency includes this loss but energy recovered by gas engines is based on low heat value so conversion is necessary.

Thus, 13.3 cu. ft. of 1000 Btu. gas is required which at 10 cents will cost 1.33 mills. This is reduced by 8 per cent when auxiliary power is externally supplied but the cost of steam-generated power will balance this out.

Average heat rate for the turbines is 10,000 Btu. per kw. hr. This must be divided by a boiler efficiency of 84 per cent, a plant efficiency of 95 per cent, and a rectifier plant efficiency of 94 per cent to convert to dc. power cost. With 10-cent gas this figures to 1.35 mills per kw. hr.

*Rotor of dc. generator viewed through access door in engine base. Thrust bearing supporting rotor is in lower housing.*

Other expenses such as operating and maintenance labor are expected to bring the costs to approximately 2 mills. With lube oil costs, etc. figured a difference of about 0.1 mill is expected.

The gas engines offer the advantages of rapid installation and the ability to produce dc. power directly. They can provide voltages from 0 to 700, a desirable feature during the starting-up operation. The small size of the units makes the problem of standby power negligible. On the other hand, the large size of the steam units requires that substantial standby power be on hand in the event of failure of a turbo-generator.

In addition, greater capacity must be installed to compensate for the rectification losses. Rectifier capacity is a sizable item of capital cost. Mr. Scheer figures that it adds about 50 per cent to the generating equipment cost.

Steam power does offer the advantage that it can be converted to use oil (residual fuel) or coal. For plant service and gas engine auxiliary needs the 60-cycle ac. power has the advantage that standard and less expensive electric motors can be used.

**This plant is part of a general mine-to-metal company expansion program involving nearly $200,000,000.**

It is impossible to build a plant of this size with its huge raw material requirements without also similarly expanding the sources of supply. In this case, provisions were made for an approximate 60 per cent expansion over original rated capacity of the company's Baton Rouge alumina plant and facilities to increase bauxite production at its Jamaica, British West Indies, ore deposits.

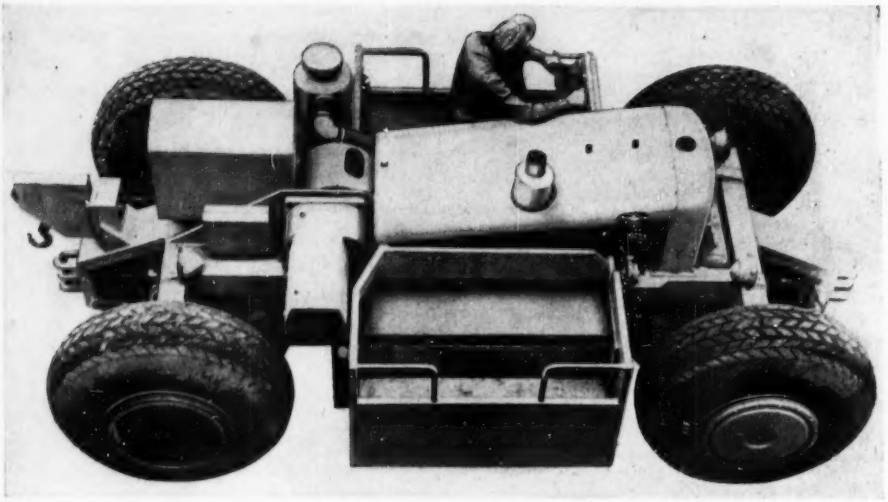
Kaiser Engineers, one of the Kaiser organizations formed for various engineering activities, have successfully solved major problems of varied types. Apart from those peculiar to the site, are those of designing two different types of power plants of major size, raw materials handling and processing facilities, metal handling equipment as well as the huge potlines themselves.

Execution of the entire Chalmette plant project is under the direction of George Havas, vice president, general manager and chief engineer of Kaiser Engineers; L. H. Oppenheim, his assistant; and E. C. Anderson, manager, Aluminum Division, Kaiser Engineers. Operation will be under W. W. Watkins, general superintendent, Power Division, and F. W. Douville, operating superintendent, both of Kaiser Aluminum and Chemical Corporation.

## Principal Equipment and Accessories

| | |
|---|---|
| Engines | Nordberg Mfg. Co. |
| Ignition System | American Bosch Corp. |
| Governors | Woodward Governor Co. |
| Lubricators | Manzel |
| Generators | General Electric Co. |
| Jacket Water & Lube Oil Coolers | The Trane Co. |
| Motors | Reliance Electric & Engineering Co. |
| Jacket Water Pumps & Motors | Allis-Chalmers Mfg. Co. |
| Lube Oil Pumps | De Laval Steam Turbine Co. |
| Motors | General Electric Co. |
| Lube Oil Transfer Pumps | De Laval Steam Turbine Co. |
| Motors | Master Electric Co. |
| Lube Oil Purifiers | Honan-Crane Corp. |
| Lube Oil Centrifuges | The Sharples Corp. |
| Building Air Washers | The Trane Co. |
| Building Air Blowers | Buffalo Forge Co. |
| Scavenging Air Blowers | Buffalo Forge Co. |
| Motors | General Electric Co. |
| Intake Air Filters | American Air Filter Co., Inc. |
| Exhaust Silencers | Burgess-Manning Co. |
| Gas Meters | Rockwell-Emco |
| Pressure Regulators | Mason-Neilan Regulator Co. |
| Instrumentation | |
| Alarm Systems & Cubicles | General Electric Co. |
| Pyrometers | Illinois Testing Laboratories, Inc. |
| Gauges | King Engineering Corp. |
| Tachometers | James G. Biddle Co. |
| Manometer | Meriam Instrument Co. Inc. |

*Elevation and plan view, at left, show arrangement of the major components involved in each engine installation. Jacket water and lube oil cooling circuits as well as multiple use of stack can be seen.*



*Powerful, maneuverable and highly adaptable, the Tournatow was developed specially for use with heavy construction machinery.*

# The Tournatow—Diesel Electric Tractor

**Most recent addition to the heavy equipment field is this diesel-electric powered tractor driven by d-c motors mounted on each wheel shaft. Simple to operate, smooth application of power, and precision control are advantages offered with this type of drive.**

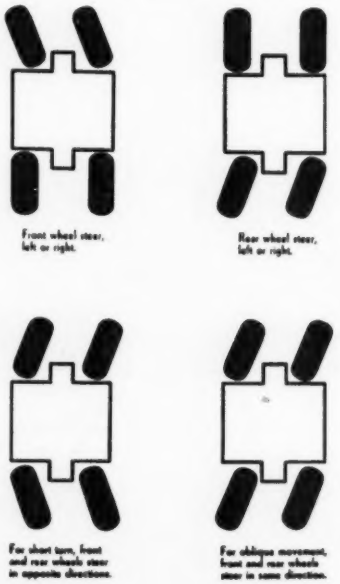
A MACHINE with no clutch, transmission or differential and employing a new method of power transmission has been introduced by the R. G. LeTourneau Company. Known as the "Tournatow" it has demonstrated the advantages of electric power control to heavy earth moving equipment. Performing recently before military officials, it attracted great attention by its ability to handle aircraft weighing as much as 400,000 lb. with smooth power and precision control.

Operation of the machine is quite simple and operators need little training before taking over. The element of human judgment as to what gear to use for a given set of conditions is eliminated and the unit is consistently operated for maximum output.

Power for the Tournatow is supplied by a GM 6-cyl. 2-cycle, diesel engine capable of developing 186 hp. at 1800 rpm. and driving direct and alternating current generators mounted in line with the engine. The direct current generator supplies power to the driving motors, one of which is mounted on the axle of each wheel, and the alternating current generator taking care of the power requirements for the two steering motors and large capacity winch mounted on the rear of the unit.

These motors and generators were originated and developed by the company principally for use on heavy construction equipment. So powerful are the ac. motors, that one 11 in. in diameter can develop 50 hp. and can accelerate from standstill to top speed of 3600 rpm. in 1/6 of a second, or they can stop and then reverse themselves in ¼ of a second.

*Illustrating steering variations.*


Front wheel steer, left or right.
Rear wheel steer, left or right.
For short turn, front and rear wheels steer in opposite directions.
For oblique movement, front and rear wheels steer in same direction.

Steering motors are located at the front and rear of the unit (one for each set of wheels) and are individually controlled from the cockpit by means of finger-tip switches. Limit switches automatically cut off the steering motors when the wheels reach their limit of turn.

Finger-tip switches on the control panel are also used to control the winch. Operating through a patented fairlead bracket on the rear of the machine's frame structure, the winch is permitted to pull through an 180 deg. arc with a maximum side pull of 90 deg. from the axis of the machine. A line pull of 30,000 lb. can be exerted by the ac. motor and reduction gear at line speeds up to 60 ft. per min. An automatic brake on the winch motor will hold the load instantly when the operator releases the control switch.

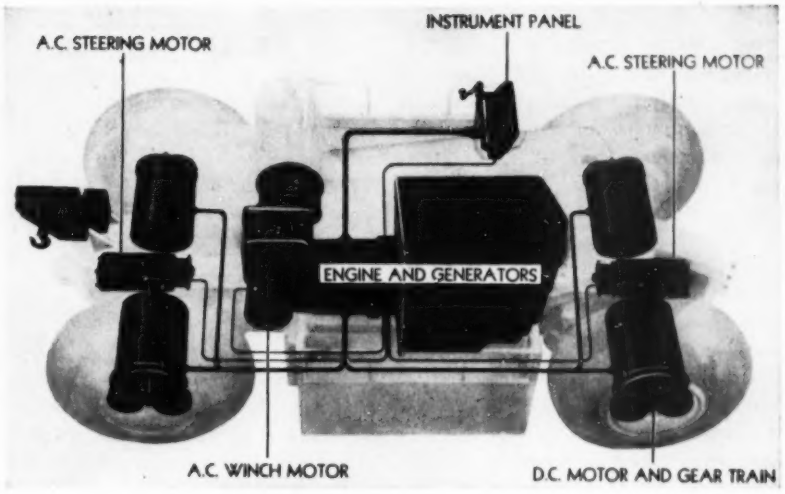
Each drive wheel is suspended on ball and socket type bearings with drive motor, reduction gear train, drive gear, and wheel built as a single unit. There are only four moving parts in each wheel—the pinion, two reduction gears, and the internal gear within the wheel. Wheels are interchange-

able, and can be removed by disconnecting the wires to the motor and taking off the socket caps. Tires are of the aircraft type and are 56 in. in diameter.

A 12 cfm. air compressor, driven by the diesel engine, with compressed air tank and 50 ft. of hose on a spring reel are provided for handling any service requiring compressed air.

By virtue of the combined ac. and dc. systems, the unit can be used as an auxiliary power plant. Welding equipment, airport and base lighting facilities and other electrical units can be easily handled by the large capacity in line generators.

A feature of this machine from an overhaul standpoint, is the ease with which the power plant (ac. and dc. generator and diesel engine) can be removed for service. To do this it is only necessary to remove four bolts.




## Tournatow's AC. System

With the introduction of an ac. system of control, most of the difficulties of more conventional methods of control such as mechanical, hydraulic, and pneumatic have been overcome.

Essentially, the Tournatow's ac. electrical system consists of an engine-driven generator which provides current for electric motor operation, ac. induction motors located at the various points of a power application, and a system of remote control so that electric motors for steering and winch operation can be operated from the cockpit. Alternating current was selected for these applications because of its starting, stopping and reversing characteristics.

The ac. generator is a 3-phase unit designed and constructed to produce current without the fluctuation and the power loss of the ordinary ac. machine.

A two unit transformer group mounted on the ac. generator provides excitation current for the generator field and charges the batteries. Rectifiers convert the alternating current from the transformers' secondary windings into the direct current necessary for field excitation and battery charging.

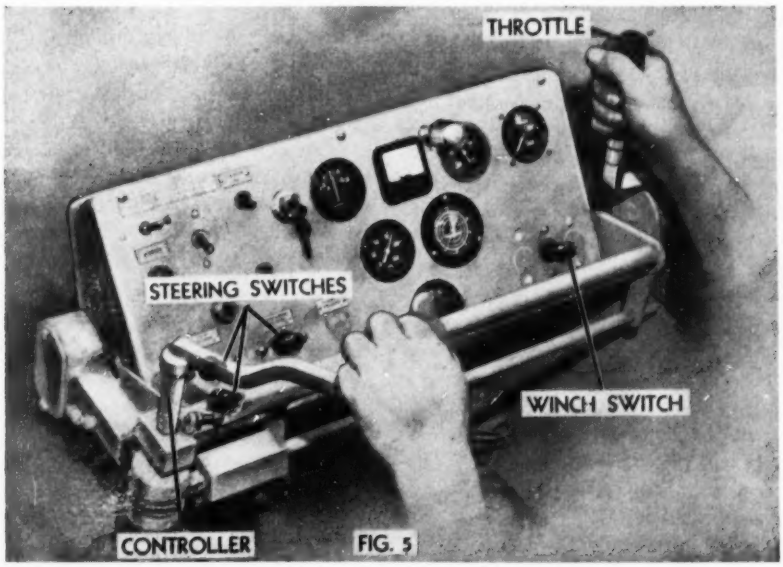


FIG. 5

A constant voltage transformer with a built-in "three-way" action is interconnected in the generator excitation circuit to maintain constant voltage at the ac. generator regardless of the varying loads experienced during the operation cycle. This transformer is of the current transformer type with a reactor coil between the primary and secondary windings. Under the "no load" condition the secondary (through a selenium plate rectifier) impresses a small additional voltage on the excitation circuit, keeping the ac. voltage up the specified 300 volts. When a load is imposed on the system and the ac. output voltage tends to fall off, the surge of current drawn by the loaded motors through the primary windings (connected in series with the feeder lines to the ac. motors) induces higher voltages in the secondary windings, in turn increases field excitation voltage, and results in an increase in generator output back to 300 volts. As the generator output voltage tends to increase beyond the specified 300 volts due to a further increase in load, the induced voltage in the secondary windings then opposes the increase, thus restricting the ac. voltage in the system to the specified voltage.

The output of the main transformer unit provides "no load" excitation current and the current used to charge the batteries. This transformer is designed to provide stepless adjustment of the charging rate without changing electrical connections. To accomplish this, the magnetic circuit between primary and secondary windings includes

a movable "flux-bridge" which can be raised or lowered to change the reluctance of the magnetic circuit and consequently the transformer output.

The unique feature of the LeTourneau ac. induction motor is the method used to obtain the high rotor resistance which enables it to develop the high starting torque required for construction equipment applications. This motor has built-in rotor resistance in the form of a stamped stainless steel resistance bell. The heavy copper rotor bars extend through the rotor laminations and are flared outward and upward and welded to the bell. On the opposite end these bars are welded to a low resistance iron ring. The combination provides a variable resistance by taking advantage of the unusually high temperature coefficient of resistance of stainless steel.

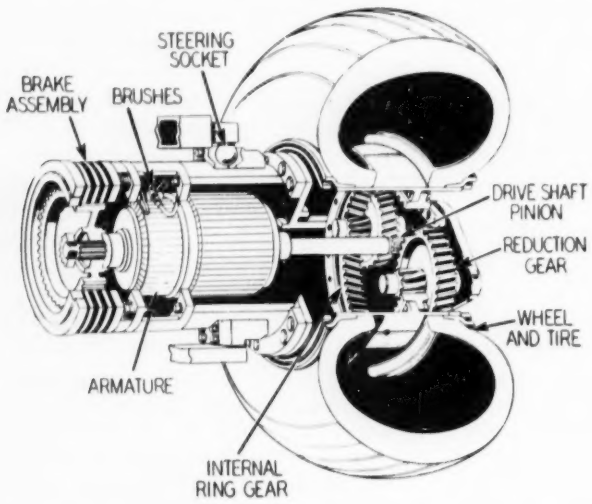
When the motor is started under heavy load, high induced rotor current causes the stainless steel resistance bell to heat rapidly and thereby raise its resistance resulting in a high starting torque. The effect is the same as the insertion of a starting resistance in a wound rotor motor.

As the speed of the rotor increases, cooling air flows over the stamping by fan action on the finned bell, thus reducing the temperature, decreasing rotor resistance and increasing motor efficiency and speed. In starting heavy loads the stainless steel bell can actually get red hot without damage to either rotor or stator since the heat is generated beyond the windings.

Automatic multiple disc motor brakes support the motor loads when the motors are not in operation. The brakes are applied by strong coil springs and are released by the pull of magnets energized when power is applied to the motor. When the power goes off, the brakes go on—no extra control switches or relays are used.

## DC. System for Electric Drive Wheel

After reviewing the requirements of drive systems on rubber-tired vehicles, dc. was selected for the Tournatow because of the excellent starting torque of these motors and the wide range of speed control possible. An engine-generator set connected to the drivers only by flexible conductor cable, and driver wheel units including both the reduction gear train and the dc. motor, completely eliminates mechanical gearing and linkages. Power loss is thereby reduced to line loss between the motor and generator and the loss in the simplified gearing system in the drive wheel.




*Sectional drawing of one of the wheel assemblies. Each of the four wheels incorporates its own drive, reduction gearing, and brake assembly.*

Control of the driving motors is by means of potentiometers mounted on the control panel, which makes possible a smooth flow of power while the load is being accelerated, eliminating the reduction of engine speed while changing speed ratios as in conventional drives.

Field excitation for the dc. generator is supplied by the ac. generator through selenium plate rectifiers and is controlled by the potentiometers. These potentiometers (mounted on a common shaft) not only control the speed of the dc. motors, but also by a patented method of interconnection change the direction of current through the generator field and consequently reverse the rotation of the motors without the use of circuit breakers in the lines. By this method it is possible to control the high amperages in the feeder lines by controlling low amperages in the field excitation, keeping high currents completely apart from the controls. By varying the field from zero to maximum in either direction an infinite number of speed ratios are possible.

The characteristic regenerative braking effect of the dc. motors is used to a great advantage in this application of the dc. system. Operating on grades where the tendency of the load is to overspeed the motor in conventional units, the dc. motors automatically take on the work of retarding the load. This effect eliminates the necessity for a braking system used during operation. However, since this effect does not exist as long as the motor armature is at rest, a parking brake is built onto the motor to lock the armature when no current is applied to the dc. motor. This brake is a multiple-disc, magnet-released, spring engaged unit, mounted on the rear of the motor frame.

As long as current is flowing in the dc. system, the magnet is disengaging the brake. When the current is cut off, powerful springs engage the brake and lock motor armature, holding the load in position.

In operation it is only necessary to advance the throttle of the diesel engine to turn the generators at the required speed, after which, the manufacturer states no further use of it is necessary, all control to the wheels being through the potentiometer.

It is expected that this new machine will bring forth great strides in the heavy equipment industry. That its usefulness will not be confined to earthmoving or materials handling is assured by the fact that its principle of spotting electric power where it is needed—at the point of action—answers many of the problems facing designers of modern equipment.

# Washington Slant

CEILING PRICES FOR MIDDLE DISTILLATES including kerosene, fuel oil and diesel oil will not be upped if OPS has its say. Director DiSalle told the Petroleum Administration for Defense that they could not accept a recommendation for increases ranging from four to six-tenths cents per gal. Basis for decision is that it is a costly and inefficient way of solving any shortage that may develop. Incentive to avoid threat of shortage was PAD's reason for asking hike. DiSalle would invoke powers of allocation and direction, etc., as alternative.

MACHINERY INSTALLATION AND ERECTION now comes under new pricing regulations. CPR 30 governs where the services are derived from special operational problems and manufacturing skills on equipment sold (and priced) on an installed basis. Where concrete, masonary, piping, wiring, and other related specialized construction materials and skills are involved, pricing should be under CPR 93 as for other contract construction. Where engineering and supervisory services are part of contract for installation or erection, installation contract is also under CPR 93.

FIVE CMP DIRECTIONS relating to status and adjustment of delivery orders have been revoked. They include: Dir. 7 to CMP Reg. 1; Dir. 1, 2 and 3 to CMP Reg. 3; and Dir. 3 to CMP Reg. 6.

FORGINGS ARE IN SHORT SUPPLY and NPA warns of still greater demands as industry gets out of tooling-up phase. Drop Forging IAC has requested assistance in materials and tools. Another bottleneck is NPA's 45-day inventory provision. Five-year history averages 96-day inventory. Nature of industry where frequently 45 days are necessary for testing of new forgings and die blocks was cited.

INTERNAL COMBUSTION ENGINE IAC (gasoline and diesel engines over 750 rpm.) confirmed shortages of forged crankshafts and hot-rolled bars. First Quarter 1952 allotments will allow 800,000 engines (all types) to be constructed in that period.

SURVEY OF GAS DEMANDS AND STEEL REQUIREMENTS by PAD will attempt to get a firm forecast of the gas industry through the next several years. 200 gas companies have received comprehensive questionnaires. Asks for company estimates of demand growth if mobilization demands continue without all-out war. Also seeks estimates of steel needed for gas gathering, transmission, distribution and storage to meet demands. DPA allocations to PAD are dependent on forecasts. Patterns of availability and distribution of gas will greatly affect future of gas and dual-fuel engine usage.

ALUMINUM PRODUCERS IAC brought out that backlog of unfilled orders for aluminum and aluminum products threatens to reach 190 million lb. by June 30, 1952. NPA plans to reduce allotments to hold near 70 million lb. mark. New gas engine powered potlines will help—NOW. Deal with Britain for loan of 5000 metric ton per Quarter for last three Quarters will also help some.

OTHER BRITISH MATERIAL DEALS include sale to Britain of 1,400,000 net ton of steel or equivalent in ore, scrap, or pig iron in 1952. In turn, U. K. delivers 20,000 long ton of tin in same period. Steel prices will be at controlled price of mills making delivery. We buy tin at $1.18 per lb. Sounds tough to lose all that steel, but it is being found that full steel utilization of current allotments is difficult unless geared to availability of other materials. Seems to be a case of who needs what most.

RAILROAD EQUIPMENT ORDER NPA M-95 is intended to provide scheduling of deliveries to meet defense mobilization needs. New order sets up reporting procedures for locomotive and car manufacturers. NPA is authorized to direct deliveries and change production schedules upon request of claimant agency. Makers must report proposed production and deliveries quarterly and actual deliveries monthly.

SECOND QUARTER ALLOTMENTS have been set. Military take is generally higher than for previous quarter. Unavailability of copper is cited as greatest limiting factor for all Second Quarter production. Allotments for some of the major programs are:

| *Division* | *Total Steel (tons)* | *Total Copper & Copper Alloys (000 lb.)* | *Total Aluminum (000 lb.)* |
|---|---|---|---|
| Engine & Turbine | 588,330 | 30,893 | 3,299 |
| General Compenents | 203,225 | 182,456 | 21,004 |
| Motor Vehicle | 3,009,760 | 106,683 | 59,400 |
| Railroad Equipment | 1,599,141 | 84,320 | 4,684 |

Comparison with allotments for First Quarter 1952 (see Diesel Power, November, 1951) shows first two categories generally up, last two revised generally downward.

# Some Methods of and Results Obtained by Evaluating Used Railroad Diesel Engine Oil

*Does oil wear out? When must oil be changed? Some efforts to make possible estimations of the answers to these controversial questions are discussed here.*

by L. A. Wendt*
*The Shell Oil Company*

BROADLY speaking, diesel lubricating oils fall into two general categories: straight mineral and additive type. The additive oils may be further divided:

(1) *Premium motor oils*
(2) *Heavy-duty oils*
(3) *MIL-0-2104*
(4) *Series 2*

It is the additive type heavy-duty group oils primarily under consideration in this discussion, and which have been much emphasized in recent years in connection with locomotive use.

## Additives

Additives are used in diesel oils to provide certain characteristics not possessed by straight mineral base oil. Briefly these materials fall into the following categories:

ANTI-OXIDANTS improve oxidation stability, permitting operation at higher temperature or for longer periods at the same temperature than is possible with straight mineral oil. They control viscosity increase, sludge formation resulting through oil deterioration and production of acidic products which may otherwise cause corrosion of critical bearing metals.

DETERGENTS-DISPERSANTS decrease engine deposits which may originate from the combustion of the fuel and/or lubricating oil deterioration.

ANTI-WEAR AGENTS increase engine cylinder and ring life by counteracting corrosive wear caused by the acidic products of combustion.

MISCELLANEOUS ADDITIVES include viscosity index improvers, pour point depressants, and foam suppressors.

Generally speaking, all heavy duty oils contain additives which perform the first two functions above mentioned. Anti-wear additives are commonly found in the Series 2 oils and in some heavy duty oils. It is not necessary to add a separate compound to accomplish each of these functions, since many additives are multi-functional and will satisfactorily serve for several purposes.

Since the additives in a new oil fulfill very definite and important functions, it is important to be able to evaluate a used oil so that it can be determined whether it is still capable of doing its job satisfactorily.

Before considering methods of evaluation it would be well to point out some of the engine factors which influence the rate of oil degradation.

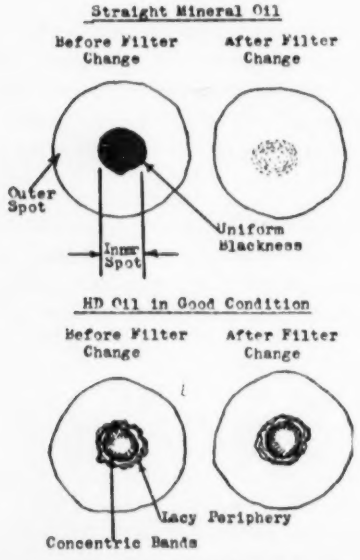
## Engine and Lubricating Oil Relationship

The life of an oil is both a function of the quality of the lubricating oil and the conditions under which it is used. Broadly speaking these conditions may be summarized as the effects of temperature and contamination.

TEMPERATURE RANGE at both ends, are important; high temperature because it greatly effects the rate of oil oxidation; low temperature because it increases rate of wear and fuel deposits.

Oil temperature is determined by the output level of the engine and the degree of air cooling. The output level of the engine largely affects local oil temperature, the temperature of the oil about the pistons, on the cylinders, the bearings, etc. The temperature of the bulk oil in the crankcase is controlled by oil cooling, which in turn then also

*An abstract of a paper presented before the Southeastern Railway Diesel Club, Jacksonville, Fla., Dec. 11, 1951.




SKETCHES OF TYPICAL BLOTTER SPOTS
Figure 1

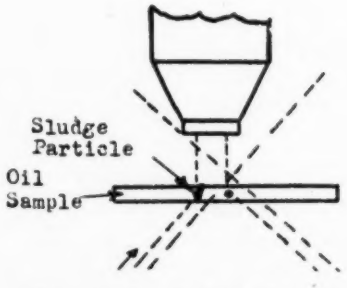



Figure 2. Principle of Dark Field Microscope.

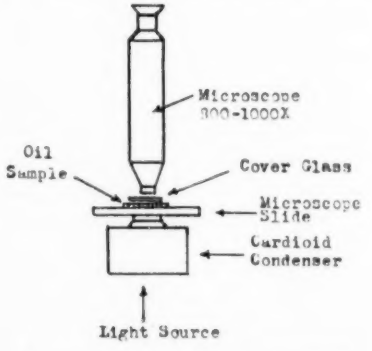



Figure 3. Laboratory Arrangement for Dark Field Microscope

affects the local temperature by the supply.

Oil cooler maintenance, therefore, is important, and oil life will depend in part on this. Proper maintenance of jacket temperature within the manufacturer's range will minimize the effects of low temperature.

CONTAMINATION of the oil includes fuel dilution from fuel line leaks or unburned fuel finding its way past the pistons, water from leaks, dust, wear products from various parts of the engine and products of incomplete fuel combustion largely composed of soot—but to some extent of other solid products of arrested combustion.

A necessary function of oil is to carry the undesirable materials from the piston area, and in this action the detergent-dispersant oils show a special advantage. These oils are capable of keeping the solid products of combustion dispersed as they are formed in very fine particles, thus preventing their agglomeration and deposition about rings and on the pistons where deposits can be harmful.

Control of factors which influence oil contamination, such as air filter maintenance, prevention of water and fuel leaks and careful attention to fuel injection systems, will greatly decrease the contamination load imposed on the oil, and will of course extend its life. Effective oil filtration will control insolubles content.

## Cylinder and Ring Wear

Oil is also exposed to certain gaseous products or combustion which are harmful to engine life. Products of fuel combustion are largely made up of water vapor, oxides of carbon, sulfur, and to some extent nitrogen oxides. These gases are potentially acid forming and the acids contribute largely to cylinder and ring wear through their corrosive action.

ACID FORMATION in this instance requires that the combustion gases combine with liquid water. It may be a bit difficult to explain the presence of liquid water in the high temperature combustion zone, but investigations have shown that under the pressures existing in a cylinder the dew point of water vapor is reached and it is possible for liquid to exist momentarily during each cycle, on the relatively cool cylinder surfaces.

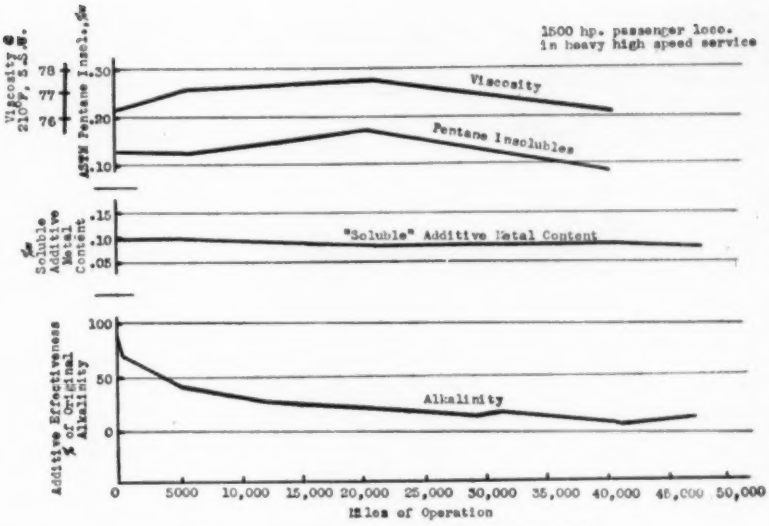



Figure 4. PROPERTIES USED OIL SAMPLES NORMAL ENGINE.

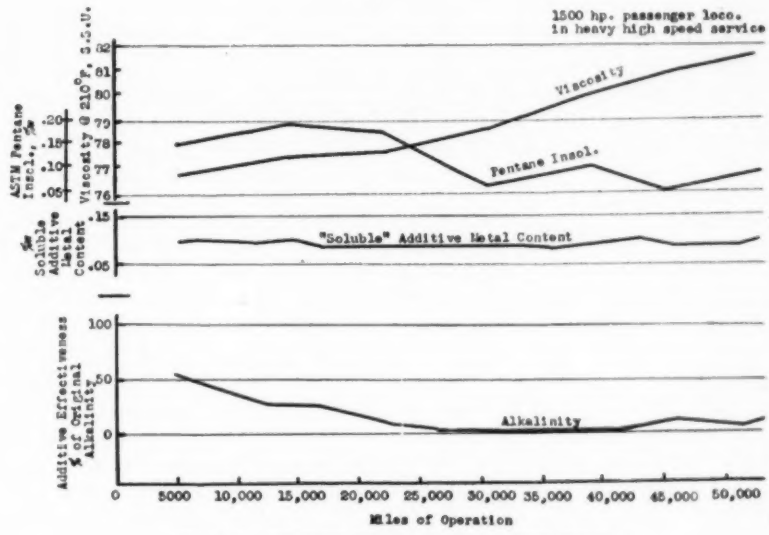



Figure 5. PROPERTIES USED OIL SAMPLES - SEVERE ENGINE.

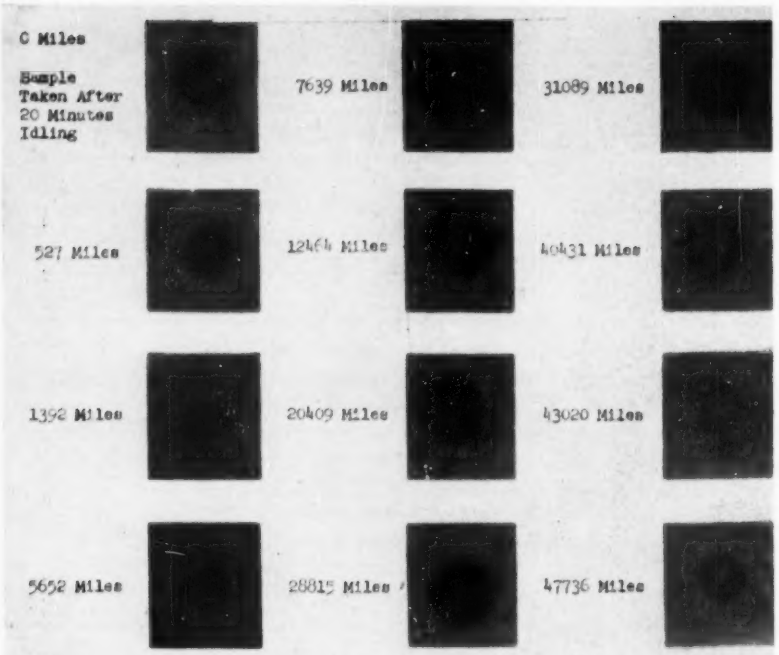
Oils specifically compounded to neutralize these acids as they are condensed, and thus greatly reduce cylinder and ring wear, can be produced.

Harmfulness of these acid gases can be greatly decreased by proper maintenance of jacket temperatures at all times, and this will keep oil additive depletion to a minimum.

## Does a Heavy-Duty Oil Wear Out?

From the foregoing discussion it can be concluded that a heavy-duty oil is exposed to conditions which cause additives present in the oil to be consumed. The base oil may not be worn out, but the additives placed in that oil to give it certain superior properties are consumed and in time the oil has little or none of these special properties. If the engine is sufficiently severe, when this point is reached an increased rate of engine deterioration can be anticipated.

The railroads commonly make a practice of treating drained oil by a process called reclamation. Many of them put concentrates into the reclaimed oil and then use this material




"Blotter Spot" Tests for Samples Shown in Figure 4
Figure 6

again in heavy duty engines. This procedure is practical only when large volumes of oil are involved, and the operation should be under laboratory control.

## Evaluation of Used Oils

The question of determining when a heavy duty oil has reached the stage where draining should be given consideration is a difficult and complex problem. Considerable disagreement exists among oil people as to the way in which this should be accomplished. This disagreement is understandable since many different types of additives and base oils are in use and therefore different methods of evaluation are indicated.

However there is some agreement in that the oil should be drained if normally measured physical properties vary significantly.

### Factors in Evaluating Used Oils

VISCOSITY is important and it should be determined because it helps to establish the presence of fuel dilution and to indicate the thickening of the oil through oxidation or contamination with insolubles. The effect of fuel dilution can be offset in part by oil thickening.

FLASH POINT therefore is used by many people to indicate the presence of fuel diluent. While this is not a precise test, combination of flash tests and viscosity give a reasonable indication of dilution. This test is also useful in indicating the presence of water (surface foam or spattering).

OIL SLUDGE content is determined by a number of methods and there is some disagreement as to the best method of test; apparently most methods have their shortcomings.

ASH CONTENT is often determined since it is sometimes considered to be an indication of the presence of additives. While this test may detect the presence of additive metals it is not necessarily an indicator of additive effectiveness. Oil samples have been inspected which had the same quantity of ash (and additive metal) as new oil, but the additives were no longer effective—the materials having undergone a change in composition which affected their ability to perform their normal functions.

ACID AND BASE NUMBER are sometimes used to indicate oil quality, and in this connection it is most desirable to get the recommendation of the specific oil supplier relative to the significance of these tests.

Some oils are basic and a measure of base number is an indication of the effectiveness of the additive present. However this may not be true for all basic oils. Acid numbers for heavy duty oils are often substantially higher than those for straight mineral oils in severe operation.

### Methods of Evaluating Used Oils

No analytical tests used to evaluate additive effectiveness are thus far widely accepted. It has been pointed out that a number of different additives are used in heavy duty oils and it is reasonable that different procedures would be in order to evaluate the effectiveness of each type.

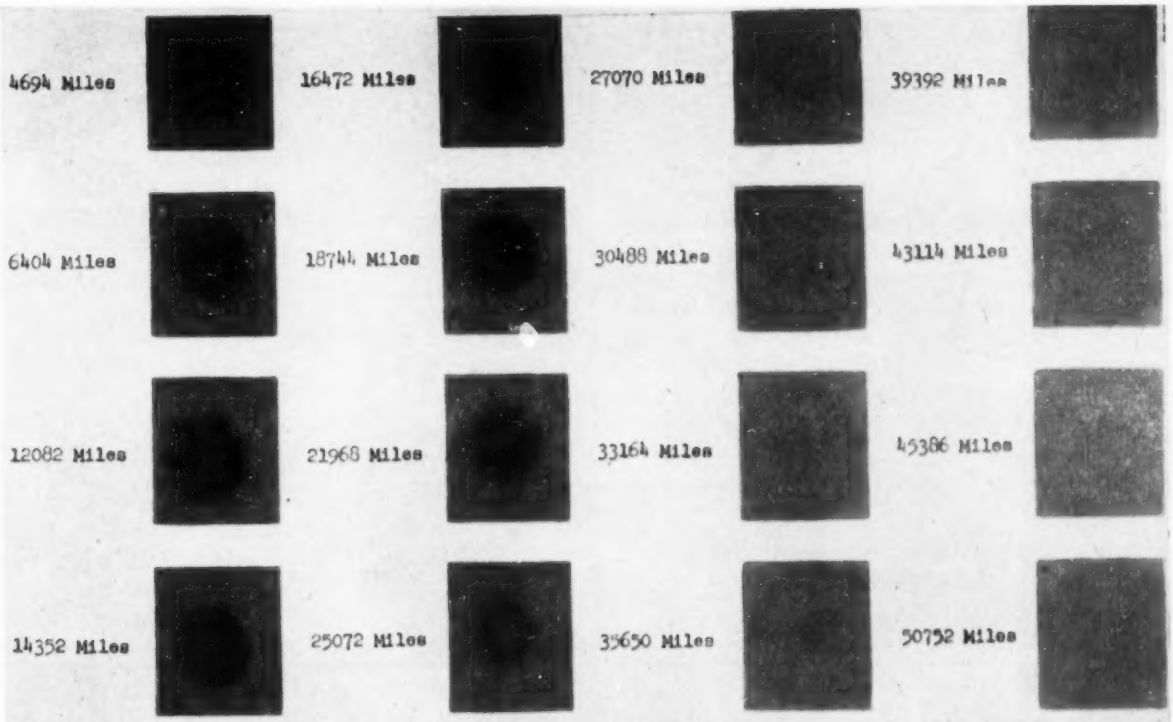
Generally speaking, the oxidation inhibitor and the dispersant-detergent are the additives with which this discussion is mostly concerned. Bearing corrosion has not been a critical problem in modern engines with oils currently used.

THE SPECTROGRAPH is being used by a number of railroads for oil evaluation. This procedure shows considerable promise of giving certain information useful in predicting engine condition as well as oil condition. While the spectrograph will determine the quantity of additive metal in the oil, it will not necessarily indicate the effectiveness of the additive.

Insofar as the oxidation inhibitor and the dispersant detergent are concerned, two rather simple tests have been found to be reasonably significant in determining their effectiveness. These tests are the "Blotter Test" and a "Dark Field Microscopic Test".

BLOTTER TEST is a familiar procedure to many railroad people. At one time it was extensively used for straight mineral oil samples to determine when filter elements should be changed. After heavy duty oils came into use it fell into some disfavor. Fig. 1 shows how this came about. With straight mineral oil there is a great difference in the density of the inner spot after a filter element change.

It is also important to notice the




"Blotter Spot" Tests for Samples Shown in Figure 5

Figure 7

difference in the nature of the inner spot for straight mineral oil as compared with that for a heavy duty oil. The straight mineral oil has a uniform inner spot while that from the heavy duty oil shows concentric bands with a lacy periphery.

Provided samples are taken regularly and some background is established, observation of the blotter spots can disclose a great deal about the oil in a general way, as indicated in the following:

(1) The nature of the inner spot indicates whether or not the oil has dispersive qualities. If the characteristic pattern for a heavy duty oil is noted, as shown in Fig. 1, there is effective dispersant present. This is true for normal locomotive service.

If filtration is inadequate the pattern of the inner spot may be obscured by an excessive burden of insolubles and the spot may appear similar to that of a straight mineral oil. Within broad limits the quantity of insolubles can be estimated by the density of the inner spot.

(2) The color of the outer spot is roughly indicative of the presence of soluble oxidation products in the oil; the oils containing a large quantity showing a dark brown color. It is necessary to consider the color of the new oil together with its normal color change in service, since there are wide differences between various oils.

(3) Presence of water can be detected. Water in heavy duty oil produces a spot similar to that of a straight mineral oil. If the series of spots from an engine show normal dispersive characteristics and then suddenly a sample shows up without the characteristic inner spot it is reasonable to assume that the oil contains water and further checking is required.

Dark Field Microscope Inspection is the other test found useful. The procedure is quite simple. Fig. 2 shows the principle of the dark field microscope and Fig. 3 shows the laboratory set up. It will be noted that the light reaching the oil sample is supplied in such a way that no rays pass directly into the microscope barrel, but find their way into the barrel only as they are reflected off a particle in the oil.

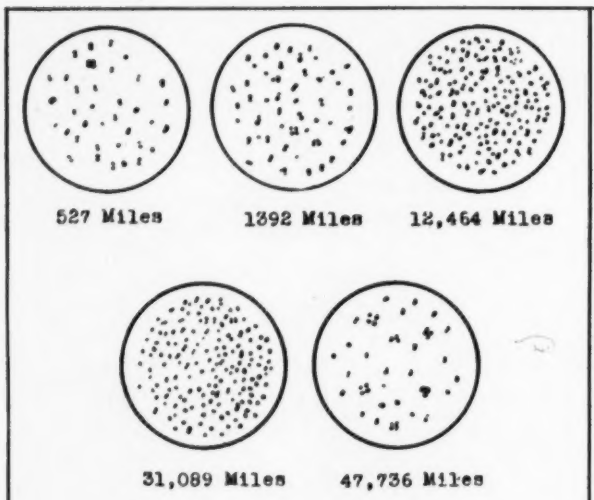
The dark field microscope serves primarily to measure the dispersion of insolubles in the oil. However, it will also show the presence of relatively large quantities of water in the sample. When water is present in the order of one or two per cent, globules of water will be noted.

## Practical Interpretations of Test Indications

Consideration of the correlation between the blotter spot and the dark field microscope with certain other used oil properties is now in order.

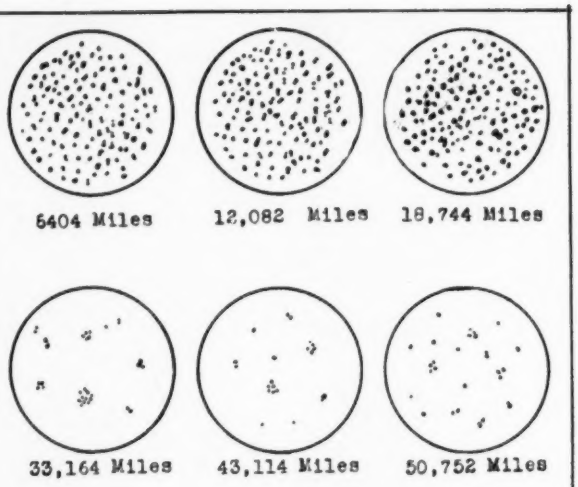
Figs. 4 and 5 show laboratory results obtained from samples from two locomotives taken between drain periods. The engines were of the same design and were in comparable high speed passenger service. The engine which gave results shown in Fig. 4 may be considered normal. Fig. 5 shows data for an abnormally severe engine which showed a consistent increase in oil viscosity.

*Reserve alkalinity* measurement pro-




DARK FIELD MICROSCOPE INSPECTIONS FOR SAMPLES SHOWN IN FIGURE 4

Figure 8




DARK FIELD MICROSCOPE INSPECTIONS FOR SAMPLES SHOWN IN FIGURE 5

Figure 9

vided a reliable indication of additive effectiveness for the type of oil used in these engines. This had been well established in laboratory engine tests and had been confirmed by field investigation.

It will be noted that for the normal engine (Fig. 4), a *reserve of alkalinity* was maintained throughout the test run, while for the severe engine (Fig. 5) there was no reserve after 33,000 miles although some was measured later as a result of make-up and less severe operating conditions.

The *additive metal content*, it will be noted, remained about the same for both engines throughout the test runs. This shows that, for this oil, measurement of additive metal (or sulfate ash) is not an indication of additive effectiveness.

The *blotter spot changes* during the test runs are shown in Figs. 6 and 7. During the early portion the inner spots increased in relative density to a maximum point and then showed a gradual decrease, except for the severe engine where the inner spot became almost invisible when the reserve alkalinity became zero.

The *dark field microscope* inspection results, Figs. 8 and 9, show that at first the quantity of particles increased and they were well dispersed. As the reserve alkalinity decreased fewer particles were noted. At the point the reserve alkalinity was zero agglomeration of the particles took place.

A faulty oil cooler was found on the abnormal engine. Thus it can be seen that the oil temperature, which is a function of oil cooler effectiveness, can have an important effect on lubricating oil degradation.

Other factors of operation of course are also important. *Water contamination* and *excessive quantity of soot* can also decrease the life of additives.

The "Blotter Test" and "Dark Field Microscope Inspections" are useful for engines other than railroad, but it may be necessary to prefilter the samples if effective oil filters are not employed on the engine, since a heavy burden of insolubles will obscure the results.

With Series 2 oils the detergent-dispersant level normally is so high that extreme dispersion will be noted even after it may be desirable to drain oil for other reasons such as excessive viscosity, or increase of insolubles content.

There are numerous cases where engines have been operated with a fair degree of satisfaction with oil drains extended to the point where heavy duty properties were not available during the later part of the periods and there are instances where engines operate without regular oil drains. Whether or not this is desirable depends largely on the severity of engine operating conditions.

## Conclusion

Various ways of evaluating used diesel engine oil have been considered in this discussion. If close control is exercised it is possible to determine optimum length of time between oil drains so that oil having heavy duty properties is used by the engines at all times. It is desirable to use such oils if maximum engine life is to be obtained.

In recent years the output of diesel engines has been ever increasing. Higher quality of lubricating oils used have helped to make this possible.

As mechanical development of diesel engines progresses and it becomes less and less important to overhaul for mechanical failures the advantages of running with heavy duty oil will become more apparent because then it will be possible to show real advances in piston ring and cylinder life through the use of oils which not only keep deposits to a minimum, but also decrease wear.

# "Down-Time" Reduced by Heat Exchangers

*by I. Shyke*

**Some years ago, Lacey Morrison, a former editor of this magazine, now deceased, pioneered in advocating indirect cooling systems. Hartford Steam Boiler Inspection and Insurance Company was also interested in the subject. A survey showed that a very large percentage of engine failures were traceable, directly or indirectly, to direct cooling systems. Soundness of this thinking is proven by today's wide acceptance of indirect cooling. The following story serves as a reminder that troubles are still occurring where direct cooling is used.**

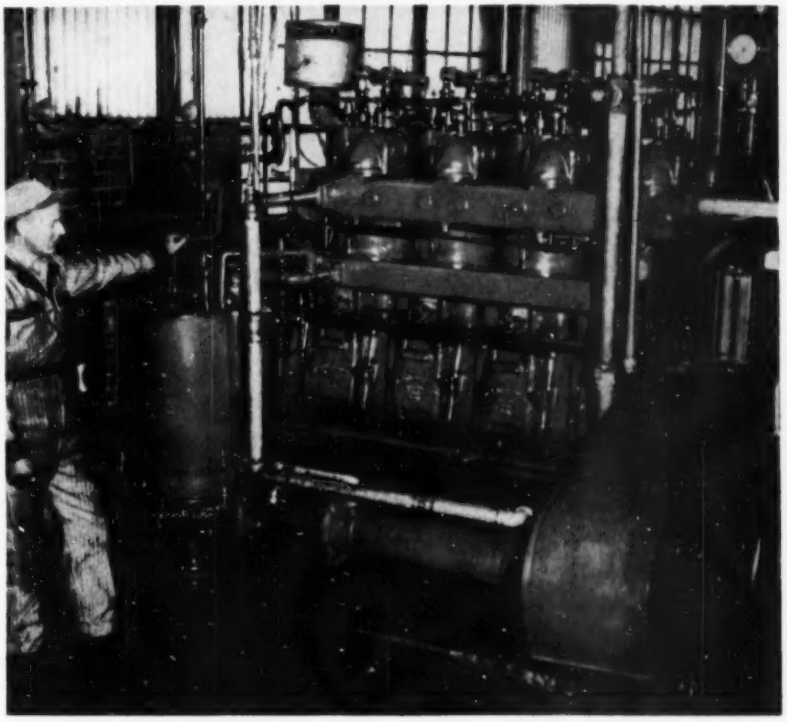
AN account is presented here on how the Vass Ice Company of Middletown, N. Y. dealt with a situation concerning an epidemic of cracked cylinder heads. This ice plant is totally dependent on diesels for all power requirements, consequently these stoppages were quite costly from a production as well as a maintenance standpoint.

At first the trouble was attributed to steam pockets in the head which prevented the cooling water from coming in contact with the head in the vicinity of the pocket, and then overloading of the engines was considered, but both of these possibilities were disproven.

The real source of trouble was traced to the direct type of cooling system that permitted uneven temperature and distribution of too cold water in the heads. Water was entering the engine at 70° to 80° F and leaving at only 90 to 110° F. This is obviously too cool, and on this basis it was decided to install an indirect cooling system using heat exchangers of the shell and tube type, manufactured by the Ross Heater Company. Water now enters the engine at 110 and leaves at 130° F with protection afforded on the high temperature side by an automatic control that will stop the engine if the cooling water goes above 150° F.

This equipment has been in service a year, during which time there has not been one cracked cylinder head. Previous to the installation of the heat exchangers, shut-downs due to cracked heads were averaging about ten per year with each one putting the engine concerned out of service for a period of five hours. During this time production of the plant was cut in half.

Cooling water for the heat exchangers is supplied from an Artesian well located at the rear of the plant and circulated by a Fairbanks-Morse turbine pump. The exchangers require little or no attention and are mounted on the sides of the engines where they are completely out of the way and cause no inconvenience from the standpoint of space requirements.



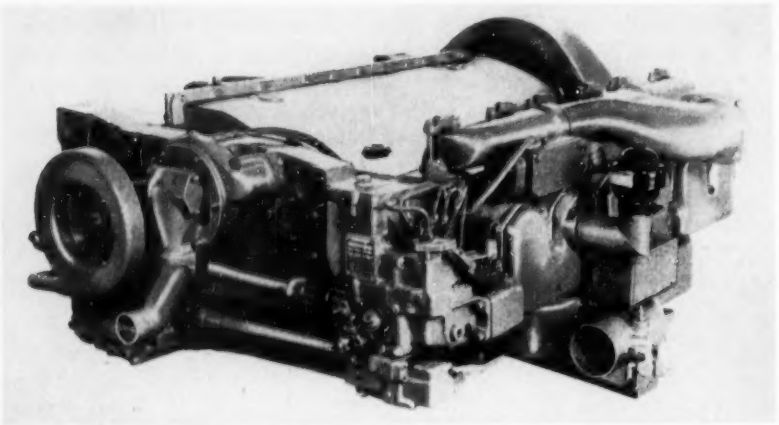
*One of the two Wolverine diesel engines used in ice making at the Vass Ice Company plant. Mr. Tetz, plant manager, views operation after the installation of the heat exchanger mounted parallel to and at the base of the engine. Higher and more uniform cooling water temperatures have greatly reduced the incidence of cracked cylinder heads and reduced sludging problems.*

Established in 1925, the firm was originally supplied with power from a power company, but in 1941 diesels were installed and today the company supplies all its own power—the only private company in Middletown with this distinction. By so doing, operational expenses have been cut by 25 per cent from $1,500.

Power for the plant is supplied by two 4-cyl. Wolverine diesels, which are capable of generating 50 kw. of electrical energy each.

On the ice manufacturing end of the plant, ammonia is used for the refrigerant with brine circulated through the freezing coils. Peak manufacturing capacity of the plant is 81 tons of ice per day.

# DIESEL BRIEFS



***New Horizontal Diesel for Buses and Railcars***

Latest addition to the Cummins line of 84 models of lightweight, high-speed diesels is a horizontal type designed for city and intercity buses, as well as rail car applications.

Known as the NHHB-600, it is a 6-cyl., full diesel which produces 200 hp. at 2100 rpm. and with a compression ratio of 15.5 to 1. Displacement is 743 cubic inches, with a bore and stroke of 5⅛- by 6-in. Weight of the NHHB-600 is 2285 lbs.

The White Motor Company, Cleveland, is standardizing on the NHHB-600 in its new 44-50 passenger transit bus, Model 1100D. In demonstrations from coast-to-coast, these Cummins powered buses have shown improved mileages and have more than doubled the mpg. of gasoline engines.

ACF-Brill, Philadelphia, is currently offering their model IC41 highway coach with the NHHB-600 Cummins diesel.

Continental trailways has used NHHB-600's in repowered IC41 ACF-Brill 41 passenger intercity buses for nearly a year on a run between Dallas and Los Angeles. Fuel consumption has averaged more than 8 mpg. during this period. As a result of this performance, Continental is repowering a fleet of ACF-Brill coaches, and is also purchasing new Cummins powered model IC41 buses from ACF-Brill.

In addition, the diesel fuel recommended for use in the NHHB-600 is lower priced than fuel burned in most other types of diesel coaches now in operation.

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### American Power Conference

The first annual American Power Conference will be held March 26, 27 and 28 at the Sherman Hotel, Chicago. The meeting will be a continuation of the Midwest Power Conference, which has been sponsored by Illinois Tech. for 13 years. The name was changed because of the national significance of the previous power meetings.

More than 50 technical papers will be presented at the 1952 meeting. On Friday, March 28, from 9:00 am. to 12:00 noon, there will be a symposium on diesel power plants.

### Fleet Maintenance Show

The National Transport Vehicle Show will be held February 26 through 28 at the 221st Regimental Armory in New York.

This show is to be twice the size of that of 1951 from the standpoint of exhibitors and is to be national in scope. Emphasis will be on salvaging of equipment to relieve the difficulty of getting replacement parts. A model maintenance shop will be set up within the show, and it will emphasize the value of installing modern tools, testing equipment, etc.

The public is excluded from the show, but anyone producing proper credentials will be admitted.

### Diesel Trucks Hauling Ore Through "Impassable" Terrain

Diesel trucks that literally climb mountains are keeping United States atomic weapons plants supplied with uranium ore from nearly inaccessible mines high in the Rockies. Hauls from the isolated uranium bearing areas in Colorado and Utah average 70 miles through an array of deserts, canyons and mesas.

For every 16 miles travelled on these hauls, 15 miles are over trails that would ordinarily be classified as unnegotiable. So-called "roads" are often only vague tracks wandering up and down through masses of rock debris. Grades on the route range from 15 to 30 per cent and altitudes reach 2½ miles above sea level. As if this wasn't enough, temperatures vary from those of hot deserts to 25° below zero in winter.

### Labrador Rail Job on Schedule

The Iron Ore Company of Canada has announced that good progress is being made on the Quebec North Shore and Labrador Railway from Seven Islands on the St. Lawrence River to the iron mines at Knob Lake, 358 miles away.

Grading is now 40 per cent, or one-third of the mileage complete. The difference is accounted for by the fact that the heaviest grades are at the south end, and are nearly finished. Total grade excavation will total nearly 45 million cu. yds. and rock cuts over a 100,000 cu. yds.

# DIESEL BRIEFS

Building of two power plants, one for power at the boat loading terminals, and the other near the mine, are also up to schedule.

Steel has been laid the first 12 miles, but has stopped there pending completion of a bridge across the Moise River, which was held up due to steel shortage. Steel laying will continue throughout the winter with the expectation of having 190 miles laid by the end of 1952. By that time 223 miles will be graded.

## Increased Ratings for 4 Cummins Engines

Refinement in engine design of four diesels, manufactured by Cummins Engine Company, Inc., has allowed the horsepower ratings for continuous-duty applications to be increased.

Cummins engineers recently introduced a full flow lubrication system and continuous groove main bearing on engine models H-600, HR-600, HS-600, and HRS-600, allowing an increase in continuous operating speeds from 1600 to 1800 rpm. New and old continuous-duty ratings for these engines are:

| Model | New Rating at 1800 rpm. | Old Rating at 1600 rpm. |
|---|---|---|
| H-600 | 102 hp. | 94 hp. |
| HR-600 | 115 hp. | 106 hp. |
| HS-600 | 140 hp. | 132 hp. |
| HRS-600 | 157 hp. | 142 hp. |

Company officials point out that this increased horsepower and rpm. simplifies the application of Cummins diesels to many types of industrial equipment. The engines may now be coupled directly to centrifugal pumps that operate at a speed of 1750 rpm. as well as to generators operating at synchronous speeds of 1800 rpm.

## Gas-Synthesis Plant Successful

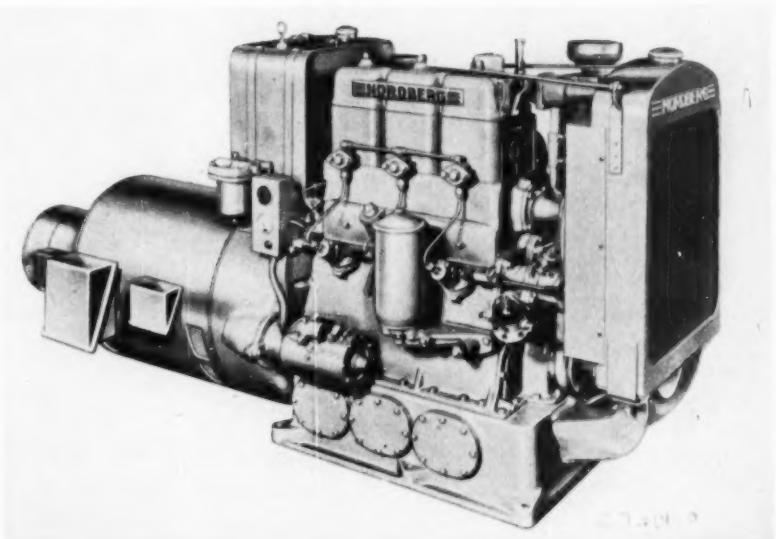
A 25 day test run of the new gas-synthesis demonstration plant at Louisiana, Mo., has been completed successfully, the Bureau of Mines has announced. The recent run proves the effectiveness of the Bureau's long-term program to adapt and improve the Fischer-Tropsch process for producing liquid fuels from coal.

Among the products produced to allow for testing were motor-grade gasoline and diesel oil, as well as synthesis gas.

In the gas synthesis process, the coal is first converted to synthesis gas, composed of carbon monoxide and hydrogen, and this in turn is converted into oil by passing it over an iron catalyst.

Synthesis gas accounts for about 60 to 70 per cent of the cost of gasoline produced from coal by the process. This fact points up the importance of reducing the cost of gas production.

The economical gasification of coal is the greatest problem remaining to be solved in connection with the developing the gas synthesis process to the point where private industry may be interested in adopting it for converting coal to oil. (This is also the headache in producing gas from coal for direct use in dual-fuel engines, a subject of much recent investigation).




### *Three Cylinder Diesel Introduced by Nordberg*

A new three cylinder diesel engine, known as the 4FS3, is now in production at the Nordberg Manufacturing Company. The new engine supplements the 4FS one and two-cylinder engines, which have been developed to meet the need for low cost, compact, heavy duty engines in the small horsepower field.

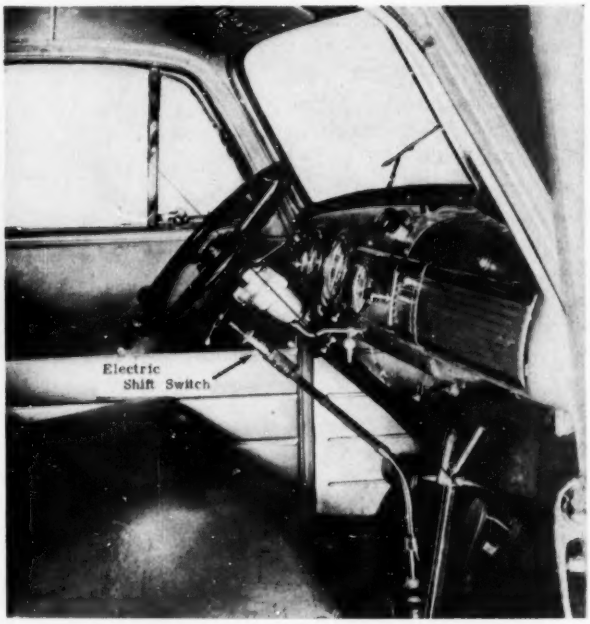
Rated at 30 to 45 hp. in the 1200 to 1800 rpm. speed range, the new unit has a bore and stroke of 4½ by 5¼ in. and is a four cycle, vertical, mechanical injection engine. Built as a complete, self-contained, ready to operate unit, it is available as a 20 to 30 kw. ac. or dc. electric generator in all standard voltages, as a pumping unit of 500 to 3000 gpm. at 20 to 220 ft. head, and with a clutch or stub shaft power take-off for direct connection or belt drive applications. For stationary work, a radiator type of cooling system is used but for marine usage the engine is available with a heat exchanger.

Regular diesel fuels are used for both operation and starting. Starting is by electric starting motor, although manual starting is available if desired.

# Diesel Truck for the Medium-Weight Field

**Cutting into the medium-weight truck field, where gasoline engines are king, is the new GMC 2½-ton diesel truck, using a three cylinder version of the "71" series engine.**

*A new 2½ tonner taking a grade with ease on the Milford, Mich., GM proving grounds. Chassis is loaded to rated capacity with concrete blocks for the rigorous tests given.*




*Cabs of the new trucks are designed for comfort, good visibility and convenience of operation. Electrical 2-speed axle control switch is on shift lever. Control is independent of vacuum or air supply.*

Newest addition to the GMC family is the D450-37, a 3-cyl, 110-hp., diesel truck—smallest and lightest diesel to be commercialized for use on American highways. Designed especially for truckers operating in the 19,500 lb. G. V. W.—35,000 lb. G. C. W., the new truck will bring diesel economies to a market where there is no other diesel competition, and should find wide usage for inter-city work as well as intra-city hauls of relatively high mileages.

Available in five different wheelbases for either truck or highway tractor models, this highly versatile truck should find wide application in the construction, moving, lumbering, petroleum, and agricultural industries to name a few.

Under the hood of the D450-37 is the GM 3-71, smaller brother of the 4-71 and 6-71 engines used in the GMC 650 through 980 model series tractor. Like the larger "71" series engines, the 3-71 employs the GM 2-cycle design, direct fuel injection, and fuel modulator.

The fuel modulator was introduced recently on the speed control governor of the "71" series engines. By automatically proportioning the fuel and air in the speed range below 1600 rpm. this device eliminates engine lugging with the resulting high bearing pressures, and insures a clean-burning engine. Other improvements were made on the "71" series engine at the same time the fuel modulator was introduced, and these have been incorporated on the engine in the D450-37. Some of the more important ones are given here.

Cylinder head and top face of the block are ground to allow a metal to metal contact. Oil and water passages are sealed by synthetic rubber rings and strip gaskets. Combustion chamber is sealed by Belleville cupped rings positioned at the top of the liners.

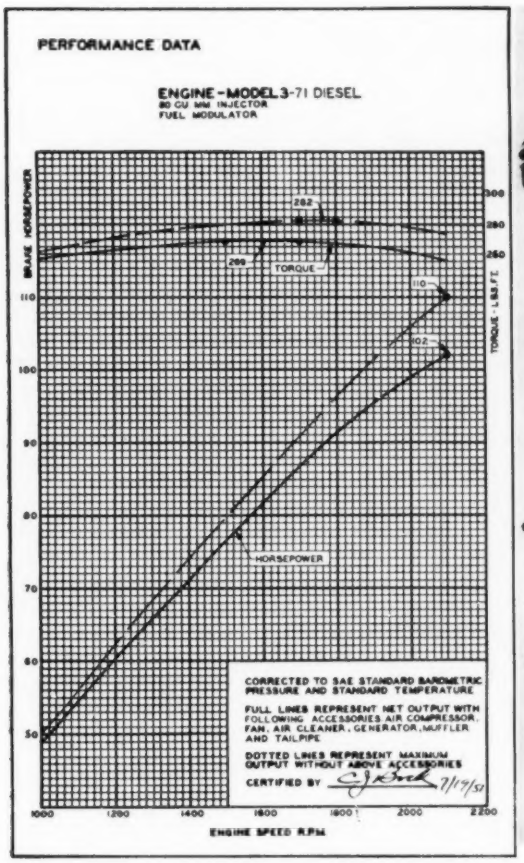
Crankcase and cylinder head are of heavy construction. Heavy walls, struts and ribs in the head and block insure rigidity and durability. Long stud bosses in the block provide deep thread engagement and eliminate cylinder distortion.

Crankshaft of the engine is dropped forged, "Tocco" hardened, and stress relieved, with roll burnished fillets and peened oil holes for protection against fatigue failure.

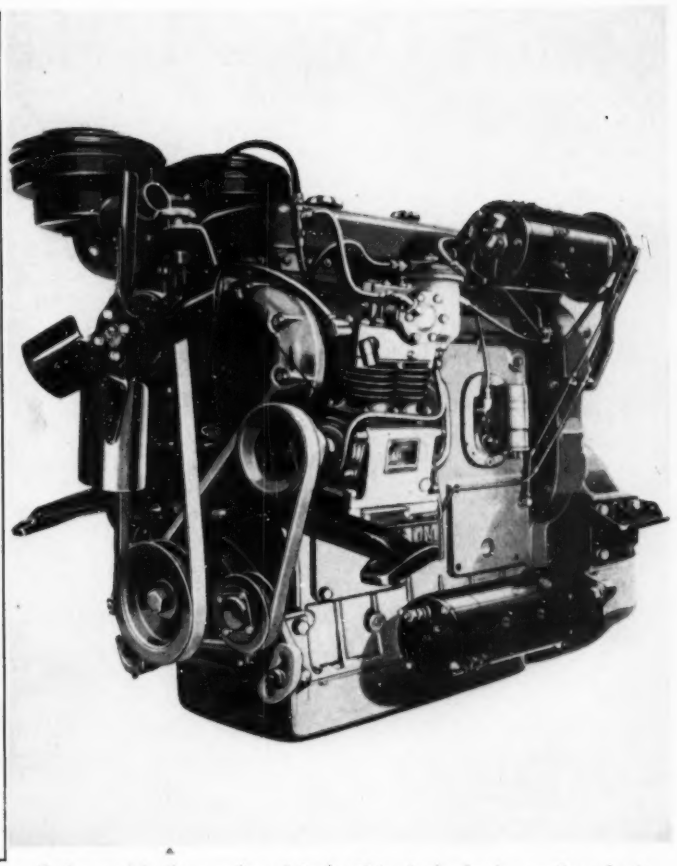
Main and lower end connecting rod bearings are of the new heavy-duty type copper-lead bearing material.

Two top compression rings are chrome-plated for long life of the rings and liners.

Exhaust valves have a stellite facing and a 30° seat angle to insure longer valve life and reduced pounding of the valves.




*Tests indicate a practically straight-line power-rpm. curve and a substantially flat torque curve peaking in a popular speed range.*



*Engine used in the new line of trucks. Note simple chassis mountings, front-end belt drives for fan and air compressor and rear drive for generator. Flame primer on rear handhole cover is used to heat airbox air for cold weather starting.*

An important feature to many truckers now using GM diesel equipment is the high degree of parts interchangeability between all series "71" engines. Among the numerous such parts are cylinder liners, pistons, piston rings, connecting rods, main and connecting rod bearings, valves, and fuel injectors. Simplified maintenance and reduced parts inventories are very beneficial to fleet operators in particular.

The brake system of the D450-37 is a combination of an air and hydraulic arrangement at both front and rear wheels. Heart of the system is an air-hydraulic unit that changes air pressure into hydraulic pressure by means of two direct connected pistons. Brake control is achieved through the customary foot pedal and hydraulic master cylinder, which operates the air control valve, thus regulating pressure on the air piston and hydraulic slave cylinder. Air system is comprised of an engine-mounted compressor of 7¼ cu. ft. capacity, pressure governor, and two air tanks. Trailer air brake connections and hand control valve are available for tractors.

On models equipped with a two-speed rear axle, the gear selection in the axle is made by an electrically operated mechanism. Control for the axle is by means of a button mounted on the transmission lever, and by moving the button up or down, an electric current to the motorized axle is controlled. This makes possible quick positive control, independent of vacuum or air supply systems, which is very important in hilly country.

Maximum geared speed of the new welterweight, equipped with 9:00/20-10 ply tires and all accessories, is 54.4 mph., and pulling power for any condition is assured by a total gear reduction of 46.9:1. It will be noted from the accompanying performance data curves, that 110 hp. is the maximum output for the bare engine, and when accessories are added maximum available horsepower drops off to 102 hp. Accessories include air compressor, fan, air cleaner, generator, muffler and tailpipe.

### Series D450-37 Specifications

| | |
|---|---|
| GVW | 19,500 lbs. |
| GCW | 35,000 lbs. |
| Wheelbases | 135, 149, 161, 179, 197 in. |
| Tires | |
| | 8.25/20 10-ply front & dual rear standard |
| | 9.00/20 10-ply front & dual rear available |
| Transmission | Five-speed overdrive |
| Front Axle | 6000 lbs. capacity |
| Rear Axle | |
| | Single speed or 2-speed—15,000 lbs. capacity |
| Service Brakes | Air operated hydraulic |
| Steering Gear | Recirculating Ball Type |
| Frame | 8-15/16 x 3-1/2 x 1/4 pressed steel |
| Electrical System | 12-volt, 50-ampere generator |
| C. A. Dimensions | 60, 72, 84, 102, 120 in. |

### The Engine

| | |
|---|---|
| Engine Model | GM 3-71 |
| Bore and Stroke, Inches | 4-1/4 x 5 |
| Number of Cylinders | 3 |
| Type | 2-cycle, valve-in-head |
| Piston Displacement | 212.8 cu. in. |
| Max. hp. @ rpm. | 110 @ 2100 |
| Max. Torque (lb.-ft.) | 282 @ 1700 |
| Compression Ratio | 16 to 1 |
| Fuel Injector Size | 80 cu. mm. |

# High Lead Copper-Lead Bearings for Slow Speed Diesel Engines

*by Albert Willi, Jr.**

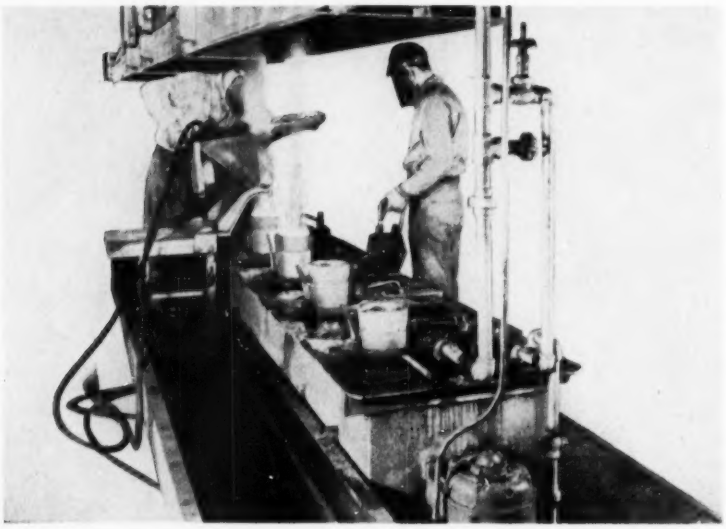
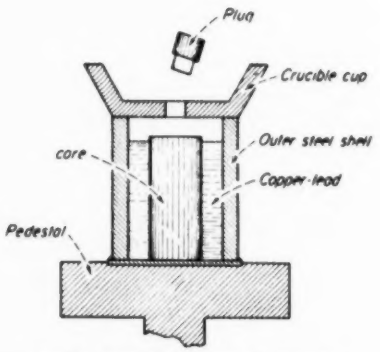


*Fig. 2. Pouring the bearing material into one of a series of casting assemblies. They are then lowered into a water bath for quenching.*




*Gravity Cast Copper-lead Assembly*

FIG. 1

FOR many years, stationary and marine diesel engines have been equipped with bronze, cast iron, of steel-backed babbitt-lined bearings. The performance record of such bearings on these slow speed gas and diesel engines is reasonably good, but due to supercharging with the resultant higher bmep. ratings of today's engines, it is believed that there is an increasing need for much better performance.

After practically exhausting all possible means of improving white metal bearings, research indicated copper-lead bearings to be a natural choice. During the time these bearings have been in general use, considerable metallurgical, manufacturing, and performance experience has been gained.

The copper-lead bearing most popular today in high speed, heavy duty engines contains lead in the range of 20 to 30 per cent with the balance copper. To obtain optimum performance, the shafts are necessarily induction hardened or nitrided. To further improve the compatibility between bearing and shaft, the copper-lead bearing surface is coated with a precision electro-deposition of a lead-tin alloy, usually .001-in. in thickness.

As copper and lead are insoluble in each other and their melting points differ by 1360° F, it is extremely difficult to cast a copper-lead mixture and obtain uniformly good dispersion of the lead in the copper matrix when the lead content exceeds 30 per cent.

Tests indicated a 40 per cent lead content suitable for use on unhardened shafts having a Brinell range of 180 to 200. This fact opened a field of application in large, slow-speed diesel or gas engines, which, for economic reasons, are built with unhardened crankshafts.

Improvements in the established casting technique were finally made which permitted the volume production of a high lead copper-lead bearing of uniformly good quality.

The casting process begins with the rough bearing assembly, as shown in Fig. 1. To the bottom of the outer steel shell is welded a bottom sealer plate. This outer shell eventually becomes the bearing back. Into the cup is assembled either a carbon or steel core and on top it is placed a tight fitting reusable crucible. The entire assembly is then placed in a neutral atmosphere furnace at about 2000° F during which time the oxygen is burned out of the rough assembly cavity. Upon reaching the proper temperature, it is removed and placed upon a pedestal projecting out of a high turbulence water tank. Molten copper-lead is poured from an induction furnace into the crucible cup. Once the cup is full, the plug is removed and the melt runs down between the core and the outer shell. The assembly is then lowered at a predetermined rate into the water tank, thus quenching it very severely to obtain the desired microstructure. After removing the crucible, machining off the sealer plate, and boring out the core, the lined tube is ready for conventional machining into a bearing. Fig. 2 shows the actual casting operation.

At the present time, the most successful bearing is described as a low carbon steel-backed type lined with a 60 per cent copper, 40 per cent lead mixture. The copper-lead bearing surface is overplated with a lead-tin alloy, containing 8 to 12 per cent tin, balance lead, to a thickness of 0.001 in. to 0.002 in.

Comparison of bearing qualities of tin base babbitt, 40 per cent lead copper-lead and 24 per cent lead cop-

**Assistant Chief Engineer, Federal Mogul Corporation.* *Abstract of a paper presented by the author at the Society of Automotive Engineers Annual Meeting, Detroit, Mich., Jan. 14-18, 1952.*

per lead bearings are given in Fig. 3.

Generally speaking, the 40 per cent lead type strikes a mean between tin babbitt and 24 per cent lead copper-lead with regard to bearing qualities. Probably the most striking improvement over the babbitt is its increased load capacity and fatigue resistance. To obtain these advantages, we suffer somewhat in conformability, imbedability, and wear rate. However, this sacrifice has not proven detrimental. You will note that the improved qualities are obtained at an increase in cost as evidenced by the economy rating.

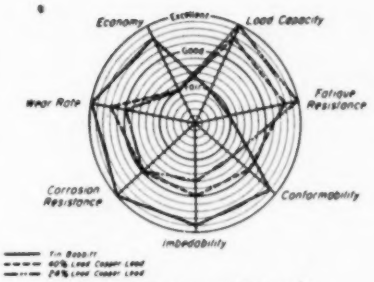
The following discussion of each individual requisite rating for 40 per cent load copper-lead bearings is based on obsevations of performance data on seven different engines, and is shown graphically in Fig. 4. Engines observed were one two-cycle and five four-cycle diesels and one four-cycle gas engine, with bores of 8 to 16 in.

*Load Capacity*—Representative load figures show a maximum crankpin bearing load of 1950 psi. of projected bearing area with a mean of 585 psi. Main bearing loadings ran 1300 psi. maximum with a mean of 425 psi. Under these loadings, shaft speeds ranged from 327 to 1150 rpm.

The loads do not represent maximum permissible values. Test rig figures showed satisfactory performance up to 3000 psi., which was the limit of the machine; but, based upon actual engine tests, it is estimated that the limiting load would tentatively be set at 2500 psi. This rating may be expected to change as more experience is gained.

*Fatigue Resistance*—This quality is far superior to that of babbitt. No bearing metal breakdown or cracking due to fatigue has been reported in 13,000 to 17,000 hours. Babbitt bearings in these same engines began fatigue cracking in 5,000 to 8,000 hours and some approached the danger point at 9,000 hours.

An interesting comparison developed in a stationary diesel which was involved in an accident that damaged one crankpin. In order to keep the engine on the line, it was necessary to hand finish the crankpin 0.010 in. undersize, with the result that the pin




Comparative Requisite Ratings for Tin Babbitt, 24% Lead Copper-Lead and 40% Lead Copper-Lead Bearings

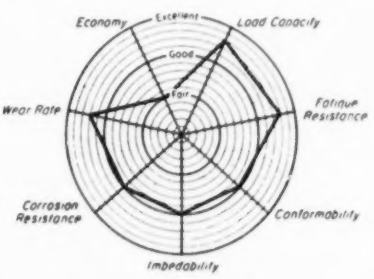
FIG. 3

ended up with 0.004 in. taper. Being originally equipped with babbitt bearings and having no 0.010 in. undersize available, a standard size babbitt bearing was installed. This bearing lasted about one week and was subsequently replaced several times in the course of two months. A standard size high lead copper-lead bearing became available and was assembled on this poor crankpin. To date, the copper-lead bearing has over 12,000 hours on it and still appears O.K.

*Conformability*—This property is, of course, enhanced by the application of lead-tin overplate 0.001 to 0.002 in. thick. It appears however, to be adequate to conform to the usual assembly irregularities and deflections of the slow speed engine.

*Imbedability*—Foreign particles in the lube oil have not been particularly troublesome in any of the engines of this type. This is, no doubt, due to the excellent filtration systems used in such applications. This property is judged to be entirely adequate.

*Corrosion Resistance*—Copper-lead is, of course, subject to corrosion by certain acids formed in the lube oil. If the recommendations of reputable oil




Requisite Rating for 40% Lead Copper Lead Bearing

FIG. 4

manufacturers are followed with regards to the type of oil and change period, corrosion presents no problem. Improved manufacturing techniques have made possible this new lead copper-lead bearing material, which is especially applicable to large slow speed engines. Although more costly than babbitt lined bearings, higher load capacity and resistance to fatigue more than warrants the increased cost.

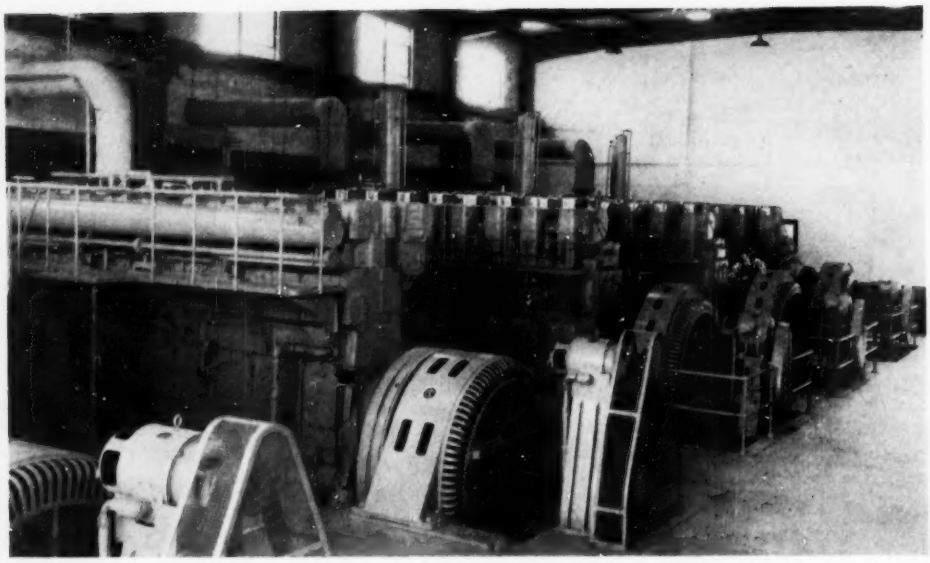
*Wear Rate*—Shaft wear with the overplated bearing has been no greater than obtained with the babbitt type. Of the seven engines covered in this report, one was equipped with a cast alloy iron shaft and the others with forged steel shafts. The steel shafts averaged about S.A.E. 1045, heat treated to obtain a tensile strength of 80,000 psi., a yield of 50,000 psi., elongation 25 per cent and Brinell hardness of 190.

The non-seizure characteristic of this copper-lead has been adequately demonstrated in laboratory and engine tests by running such bearings without the overplating. The natural bearing qualities are sufficiently good to give acceptable performance should the overplating be worn off in time. The over-plating materially assists in conditioning a freshly ground or turned and polished shaft and in equalizing concentrated loadings caused by assembly irregularities.

*Economy*—Manufacturing costs at the present time run several times that of a babbitt bearing of the same design. As the demand increases for such bearings, it is believed that it will create sufficient incentive to devise faster, better, and cheaper methods to produce them. Even at their present cost, though, the performance obtained from them appears to warrant the increased cost.

Initial testing was begun with the high lead copper-lead bearing set-up to obtain an oil clearance approximately 25 to 30 per cent more than that used with babbitt bearings. Experience since gained indicates that they do not require any more oil clearance than babbitt.

All copper-lead bearings were made fully interchangeable with their babbitt predecessors and required no alterations to the engines.



*Interior of the Creston, Iowa 6000 kw. plant, with the three Enterprise generator sets in the background and the Cooper-Bessemer units in the foreground.*

## *Report on —*

# Creston, Iowa 6000 kw Cooperative Plant

**Faced with inherent problems of**
**Water Shortage**
**Interruptable Gas Supply**
**this plant for the Southwestern Federated Power Cooperative designed by the Stanley Engineering Company of Muscatine, Iowa serves as an example of what can be accomplished by good design.**

**by H. I. Bowers and A. G. Bardwell Jr.**
*Stanley Engineering Company*

A 6000 kw. diesel generating plant of noteworthy design has been installed near Creston, Iowa for the Southwestern Federated Power Cooperative. The plant was placed in operation in 1949 and consists of two 2400-volt, 1100-kw., dual-fuel Cooper-Bessemer and three 2400-volt, 1196-kw., dual-fuel Enterprise diesel units arranged as shown in the accompanying illustration.

Prior to energizing this plant, the five member distribution cooperatives, of which the Southwestern Federated Cooperative is comprised, were served by several municipalities and public utilities.

Although tentative development plans were prepared in the early part of 1941, the work on a central power generating station was not started until 1946 when the two Cooper-Bessemer diesel generating units were purchased. On-the-site construction was started early in 1947.

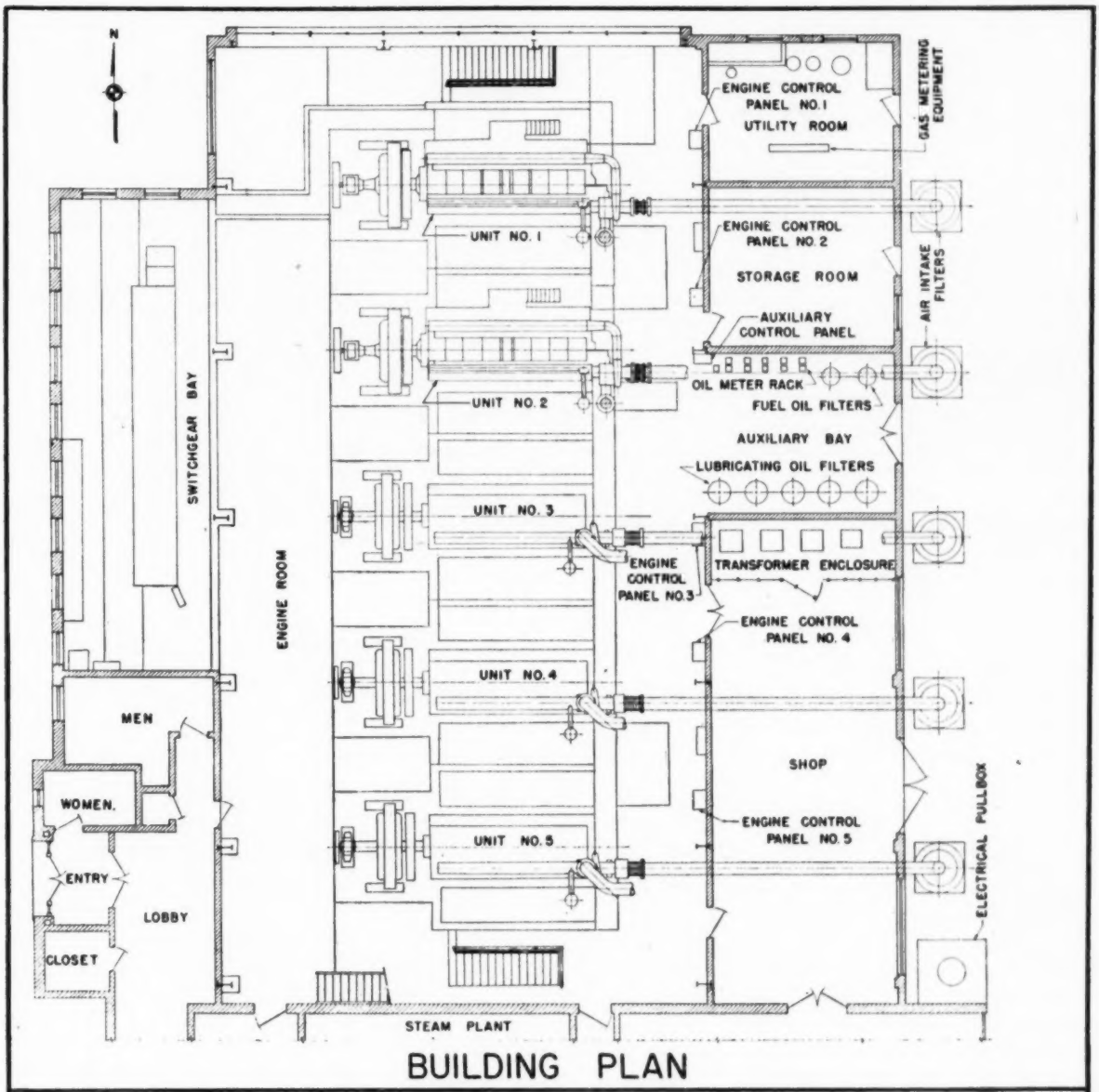
The plant was designed for installation of five diesel generating units and was provided with a temporary wall at one end to facilitate integration with a 15,000 kw steam generating plant, which is to be added sometime in the future.

### Water Supply

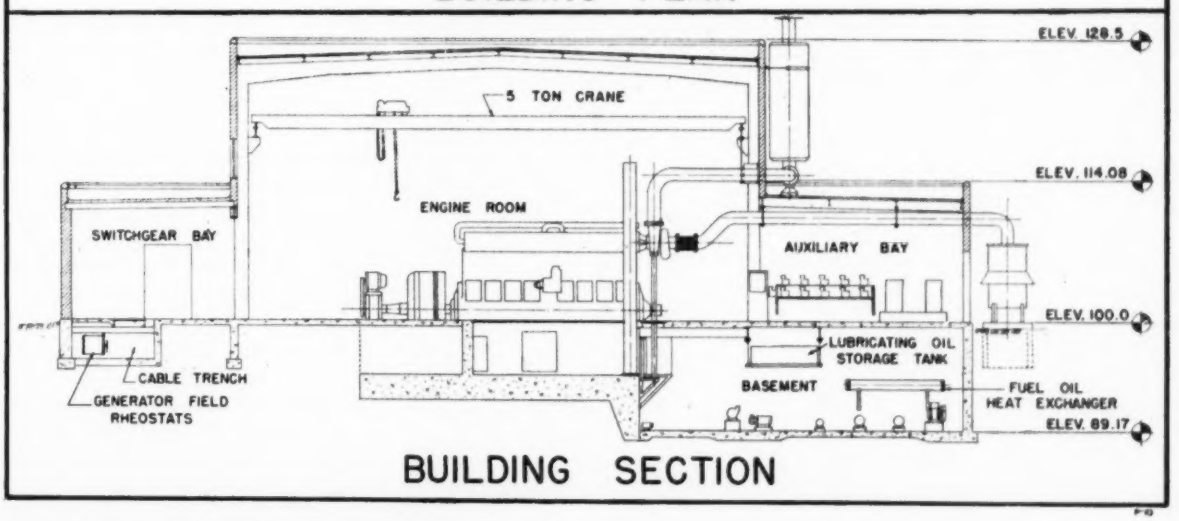
An adequate water supply for the plant at first presented a problem, as the nearest surface water was the reservoir for the city of Creston and the closest point to where connection could be made to water mains was four miles from the plant site. It was recognized that a suitable source of water was a necessity because of the steam plant which was to be added later, but the time required for such a development and the urgent need for the plant required that the design proceed on the basis of facilities which were currently available or could be readily developed.

Surveys of the area indicated that water in sufficient quantities to meet cooling tower make-up and portable requirements could not be obtained economically from wells, making any possible conservation of water highly desirable. As the region has moderate summer ambient temperatures a cooling system of the closed type employing radiators for engine cooling was decided upon.

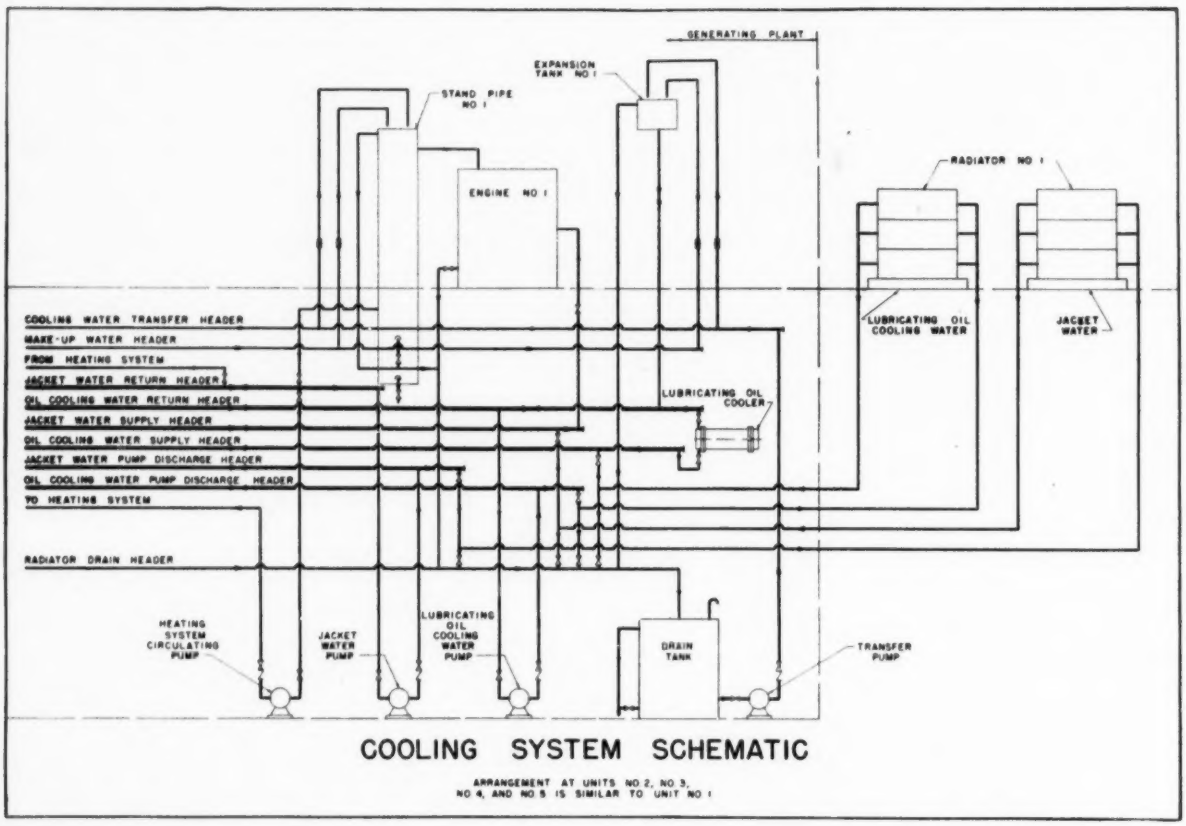
A shallow well near the plant proved capable of meeting normal potable requirements and was consequently placed in service. However, to insure an adequate water supply during any dry periods, a 7000-gal. underground storage tank with a truck fill connection was installed.




BUILDING PLAN




BUILDING SECTION




**COOLING SYSTEM SCHEMATIC**

ARRANGEMENT AT UNITS NO. 2, NO. 3, NO. 4, AND NO. 5 IS SIMILAR TO UNIT NO. 1

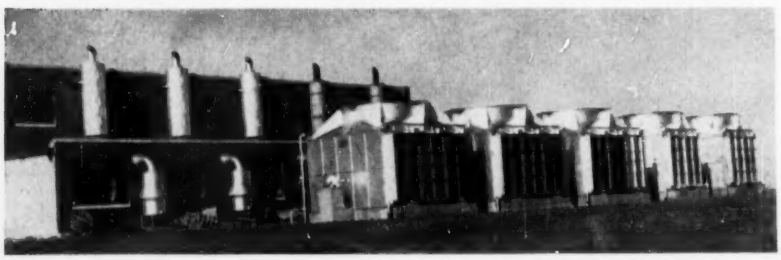
## Cooling System

The cooling system, which is illustrated here, is arranged on a modified unit-header system consisting of two independent cooling water circuits for each engine, a jacket water circuit and a lubricating oil cooling water circuit.

Each circuit is connected to the corresponding circuits of other engines by headers extending the length of the basement. With this piping arrangement, each engine is provided with a jacket water pump and a lubricating oil cooling water pump which pump water from their respective headers to a dual purpose radiator outside the building.

Each radiator contains a jacket water section and a lubricating oil cooling water section which are arranged in a quadrangular structure with the two radiator sections forming opposite sides of the quadrangle. The sides adjacent to the radiator sections are enclosed by steel panels. A multi-blade propeller type induced draft fan mounted in the top of the structure draws cooling air through both radiator sections. The radiators are equipped with thermostatically-actuated air control shutters to maintain uniform cooling water outlet temperatures under varying ambient temperature conditions and to permit independent control of lubricating oil temperature as well as jacket water temperature.

*Arrangement of the radiators, air intake filters, and silencers of the Creston plant.*



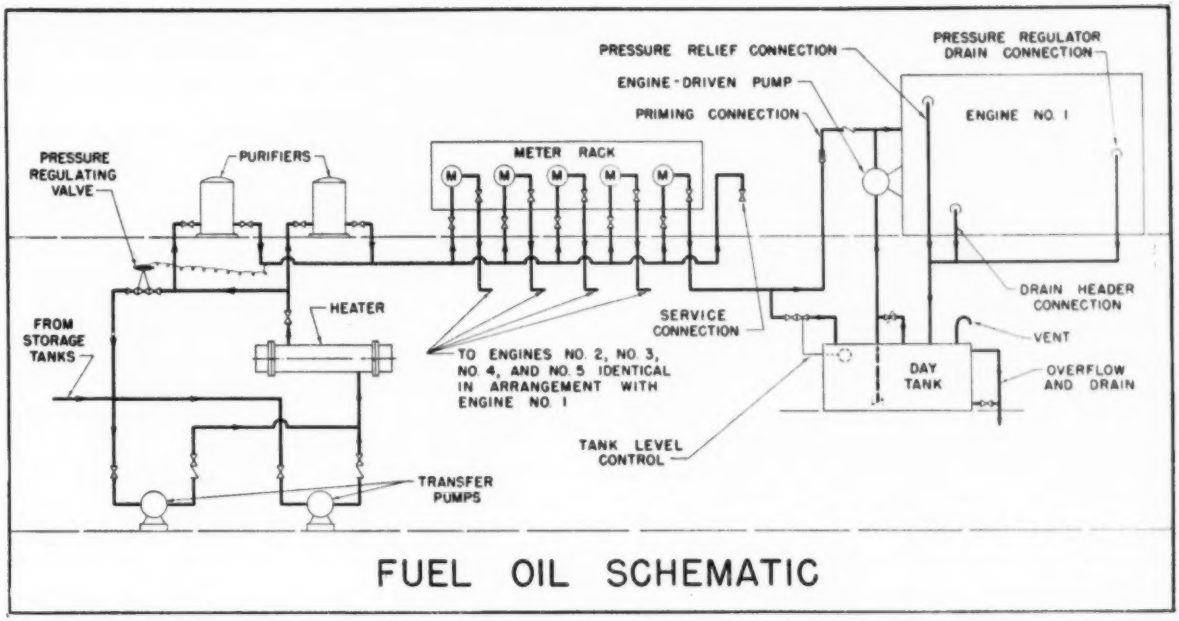
## Fuel Oil System

Fuel oil can be unloaded either from the top or the bottom of tank cars at two unloading stands. A gear-type pump is located in a small pumphouse near the storage tanks for pumping fuel oil from the cars through an air eliminator and meter to three 50,000-gal. storage tanks.

Fuel oil is pumped by transfer pumps from these storage tanks through a fuel oil heat exchanger, fuel oil purifiers and an individual meter to each engine day tank, as shown in the accompanying figure.

The fuel oil transfer pumps are arranged to operate continuously and are provided with a pressure operated by-pass valve to continuously circulate oil through the pumps to relieve the pressure at low flow. With this arrangement the fuel oil day tanks are continuously full, thus insuring a maximum operating time in the event of a fuel oil supply failure.

A priming connection is provided at each engine whereby pressure from the fuel oil header may be utilized to prime the fuel oil piping on the engine.




FUEL OIL SCHEMATIC

The fuel oil filters are of the full flow type with renewable type cartridges.

## Lubricating Oil System

Lubricating oil is stored in a 2750-gal. storage tank located in the basement auxiliary bay and is transported by a transfer pump through centrally located, individual meters to each lubricating oil sump tank eliminating the necessity of manually handling the oil.

A convenient dispensing cabinet installed in the auxiliary bay is also served by the transfer pump. Each engine is provided with an engine-driven lubricating oil pump and a motor-driven auxiliary lubricating oil pump. Oil is taken from the sump tank by the engine-driven pump and pumped through the lubricating oil cooler and a duplex strainer to the engine.

Each engine is provided with a lubricating oil purifier arranged to permit continuous purification by constant by-passing of a portion of the engine lubricating oil through the filter. The purifiers are so connected that lubricating oil may be circulated through the purifier by the purifier pump or by bleeding oil from the engine oil circulating system at a pressure of approximately 50 psig. A flow control orifice installed in the lubricating oil piping from the engine circulating system limits the rate of flow from this source to the amount required for proper purification and eliminates the possibility of excessive bleeding from the engine circulating system.

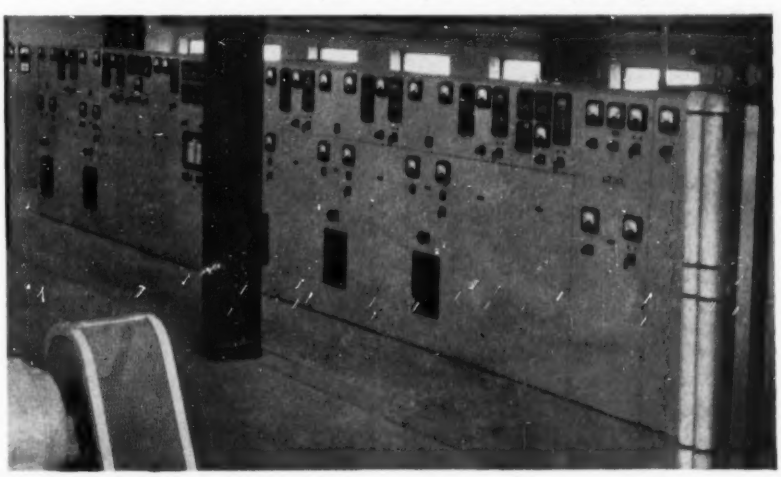
## Miscellaneous Auxiliaries

Starting air is supplied by two 250 psig. two-stage, air cooled air compressors. One compressor has a dual drive with an electric motor and a gasoline engine while the other is driven by a single electric motor.

Each engine control panel is equipped with controls for the respective radiator fan, jacket water pump, lubricating oil cooling water pump, auxiliary lubricating oil pump and lubricating oil purifier pump. Each panel also has a pyrometer to indicate various temperatures and alarms to indicate high jacket water temperature, low jacket water pressure, high lubricating oil temperature, low lubricating oil pressure, high fuel oil level, low fuel oil level, and low supercharger lubricating oil pressure.

The auxiliary control panel for the control of station auxiliaries not associated with any one engine is equipped with controls for cooling water transfer pump, lubricating oil transfer pump, fuel oil transfer pumps, fuel oil purifiers, and roof ventilating fans. The auxiliary control panel also has

*Main switchboard of the plant showing the convenient panel layout.*



alarms to indicate low fuel oil header pressures and low starting air pressure and with pressure gages to indicate fuel oil header, lubricating oil cooling water header, jacket cooling water header and starting air pressures.

The gas meter panel in the utility room is equipped with a recording, indicating, and integrating flow meter for each engine, a dial thermometer for indicating gas header temperature, and pressure gages to indicate gas header pressure and gas pressure to each engine.

The switchgear is all I-T-E metal clad consisting of a swinging panel with synchronizing instrumentation, five generator control panels and feeder panels, a bus tie panel, a totalizing panel, a station service panel, two substation feeder panels, and two transmission feeder control panels. Circuit breakers are 125-volt dc. operated air-cooled type. The three 150-kva. station power transformers and the 37.5 kva. station lighting transformers are oil cooled.

A 125-volt dc. emergency lighting system is automatically energized when ac. power fails.

## Building Design

The building is attractively finished both inside and outside and has a large picture window in the north wall.

Interior walls in the lobby, engine room, switchgear bay and auxiliary bay are provided with glazed tile wainscot and acoustical tile upper walls. The ceiling in the engine room and the lobby is also acoustically treated.

The south wall was originally constructed entirely of wood to facilitate plant expansion. Heating is accomplished by circulating jacket water through unit heaters by means of a separate heating system pump. Motor-driven and gravity type roof ventilators provide ventilation for the building.

## Performance

Annual load factor (ratio of the average load on the plant to the maximum load) on the plant was 51 per cent during 1950. As a result of the flexibility possible with the number and size of the generating units, the running capacity factor (the ratio of the gross generation actually produced to the maximum generation possible during the actual operating time of all generating units) was 78½ per cent.

Fuel rate during 1950 was 14.5 gross kw. hr. per gal. of fuel oil representing an efficiency of 33.5 per cent on straight diesel fuel oil operation. Fuel oil used is a process crude from the South Texas fields.

Plant efficiency during the period in 1950 that natural gas was available was 30.2 per cent using 7 to 8 per cent Macmillian diesel fuel as pilot oil. Natural gas is available on an interruptable basis during the months of April to November.

Lubricating oil consumption has averaged 11,634 rated hp. hr. per gal. Heavy grade lubricating oil is used in the Cooper-Bessemer engines and medium-heavy grade in the Enterprise engines.

## Personnel

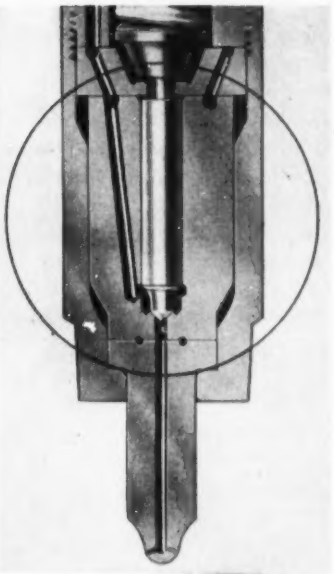
The plant has been operated under the direction of Mr. John J. Hyde, general manager, Mr. Earl Whitney, superintendent of generation and Mr. William Allen, chief operator.

The plant was designed by the Stanley Engineering Company, Muscatine, Iowa. Building work was done by the L. E. McCorkle Construction Company, Winterset, Iowa, the mechanical work by the Industrial Heating and Plumbing Company, St. Joseph, Missouri and the electrical work by the Keith Electric Construction Company, Des Moines, Iowa.

### List of Principal Equipment

| | |
|---|---|
| **Engines** | |
| No. 1 and 2 | Cooper-Bessemer, 4 cycle, supercharged, 1575 bhp., 327 rpm., 8-cyl. |
| Turbo-supercharger | Elliott Buchii |
| Governor | Woodward |
| **Generators** | |
| No. 1 and 2 | Ideal Electric, 1100 kw/1375 kva/0.8 pf. 2400 volts, 3-phase, 60 cycles |
| Exciters No. 1 and 2 | Ideal Electric, 125 volts, 20-kw. 1750 rpm., chain drive |
| **Engines** | |
| No. 3, 4 and 5 | Enterprise, 4-cycle, supercharged, 1682 bhp., 360-rpm., 8 cyl. |
| Turbo-supercharger | Elliott Buchii |
| Governor | Woodward |
| **Generators** | |
| No. 3, 4 and 5 | Electric Machinery, 1196-kw/1495-kva/0.8 pf, 2400 volts, 3-phase, 60 cycle |
| Exciters No. 3, 4 and 5 | Electric Machinery, 125-volts, 15-kw. 1750 rpm., chain drive |
| **Engine Cooling** | |
| Radiators | Young |
| Jacket Water Pumps | Allis-Chalmers |
| **Engine Miscellaneous** | |
| Air Cleaners, Oil Bath, Cycoil | American Air Filter |
| Silencers, Exhaust | Maxim |
| **Fuel Oil System** | |
| Storage Tanks | 3 50,000-gal. |
| Pumps, Transfer and Unloading | Viking |
| Filters | Hilliard |
| Air Eliminator and Meters | Pittsburgh Equitable |
| Heat Exchanger, Fuel Oil | Sims |
| **Lubricating Oil System** | |
| Storage Tank | 1 3,000-gal. |
| Auxiliary Lubricating Oil Pumps | 2 Blackmer and 3 Roper |
| Transfer Pumps | Viking |
| Lubricating Oil Cooling Water Pump | Allis-Chalmers |
| Duplex Strainers | 2 Andale and 3 Bailey |
| Lubricating Oil Coolers | Bell & Gossett |
| Filters | Hilliard |
| Meters | Pittsburgh Equitable |
| **Electrical** | |
| Switchboard, Instruments and Air Circuit Breakers | I-T-E |
| Transformers, Station Power and Lighting and Sub-Station Stepup | Uptegraff |
| Battery Charger | General Electric |
| **Plant Miscellaneous** | |
| Overhead Crane | Whiting |
| Heating System Circulating Pump | Peerless |
| Cooling Water Transfer Pump | Peerless |

# Servicing Bendix-Scintilla Nozzle Valves



*Outlining the more common causes of nozzle valve failures and the approved service procedures for their repair. Many of the thoughts expressed apply to all makes of nozzles.*

Nozzles are precision-built and require expert repair if they are to do their job. Bungling can result in costly replacement of parts when a simple — but properly performed — cleaning would have done the trick. So if you are not equipped to do the job and do not plan to obtain the necessary facilities, it is cheaper in the long run to farm out the work to injection repair shops.

You simply can't expect to pull out a nozzle and go over it in the same casual way that you would pull a spark plug for cleaning and re-gapping. They are a different breed of cat. It takes equipment and "know-how". If you have enough nozzle work to warrant the expense of the facilities, here is some of the "know-how".

Injectors are generally broken down into three major assemblies; the holder body, nozzle valve and spray tip. The last two are sometimes combined as in the case of the Type NCS nozzle. The most complicated repair procedures involve the nozzle valve so this will be the subject here.

## Preparation

Nozzles get into the injector shop for two reasons; there is some indication of their failure, either by engine performance or instrumentation, or they are coming up for check on a preventive maintenance schedule. In any case, they must be cleaned.

Openings should be plugged and the exterior thoroughly cleaned before any work begins. Preparation for the work includes provision of a clean work area: clean tools; clean fuel oil or cleaning agent in clean containers; and clean containers for holding the parts of a disassembled nozzle.

You will note that cleanliness is emphasized a little. Seriously, though, it can't be over-stressed. This line of thinking should prevail throughout all phases of the operation.

## Equipment

A good popping tester with a clean supply of fuel is necessary. Adequate filters should be installed between the storage tank and the tester for removal of micronic-sized particles that otherwise might harm the nozzle during testing.

A bench lathe or lapping head is needed. It should be equipped with accurate collets of proper sizes to hold the nozzle valve needles by the pressure pin end. Nozzle valve sizes NB, NC, and ND call for 7/64, 9/64 and 5/32-in. collets, respectively.

Two grades of lapping rouge (Bendix indicates grade by colors, yellow and green, the latter being the finest) should be at hand. Pencil honing stones are used on the valve seats. They are available in sets of six with each stone mounted on a mandrel. Mandrel diameters increase in steps of approximately 0.0003 in. to insure a good fit in the valve body in the interest of concentricity of the bore and seat.

Some means must be provided for visual inspection of the valve seats. Two to five-power magnification is also desirable. A good magnifying glass permits inspection of the needle seat, but the seat in the valve body is more of a problem. Low-power microscopes can be used but there is the difficulty of lighting the seat area. Special illuminated borescopes can be used to advantage or a doctor's battery-powered otoscope. The latter is the familiar gimmick that is used to peer into ears.

## Causes of Failure

It will be assumed that the injector has been pop tested and found deficient. The most common causes of failure (remember, we are talking about nozzle valves) are:

*Binding or sticking of the needle in the body*

*Leakage of fuel past the valve seat*

Before any attempt is made to recondition the nozzle valves, they should be thoroughly cleaned. Either of the above types of failures may be the result of dirt.

## Removing Stuck Needles

Binding or sticking needles will have to be removed from the valve body. The condition may be due to dirt or lacquer—either visible or invisible—

on the lapped surfaces. Solvents may be helpful in loosening the needle and hydraulic pressure is a most effective means for removing it.

For this purpose the valve assembly is placed in a holder body modified so that the needle, when ejected can enter the bore of the holder body. The pressure pin and spring are removed, but the adjusting screw is left in place. A spray tip without orifices or a blank washer takes the place of the usual spray tip.

In the case of the Type NCS nozzle which has the spray orifices directly in the nozzle body a special "extracting nut" is screwed on the holder in place of the regular nut.

The assembly is then placed in a popping tester and the pressure built up so as to eject the needle. Some nozzle valves may not respond to this treatment where the sticking is due to abnormal causes such as excessive heating accompanied by galling and scuffing; corrosion occurring during long idle periods, etc. In these cases the nozzle valve is probably beyond field repair and should be discarded and replaced.

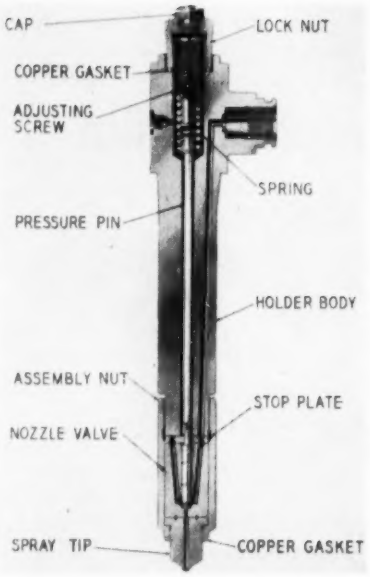
## Cleaning

When the needle and valve body are separated, they should be washed in a cleaning fluid such as Stoddards Solvent, white kerosene or fuel oil. *Make sure that these mating parts are kept together; they will not fit other parts properly.*

To be effective, only clean cleansing agents in clean containers can be used. If air is used for blowing off the parts, it must be clean and dry. Lapped surfaces must not be cleaned in containers previously used to clean carbon-coated parts.

After washing and drying the needle, the presence of invisible lacquer can be detected by wrapping a piece of paper around the stem and firmly holding it while rotating the needle. Lacquer will produce a squeeking noise.

Solvents can be used to remove lacquer or it can be done by a light lapping. The needle and valve body can be lapped together for four or five seconds using fine (green) rouge. Final cleaning to remove all traces of lapping compound is followed by reassembly under fuel oil.




*Sectional view of typical Bendix-Scintilla nozzle with nomenclature of parts.*

## Pop Testing

Retesting of the nozzle is a worthwhile step because it may be found that the removal of foreign matter is all that is needed to put the nozzle back in working condition. The needle and body should be lubricated with a light oil and assembled with a holder and spray tip. The adjusting screw should be left loose when the unit is mounted in the pop tester so that the first few strokes of the pump will flush out the nozzle.

The opening pressure should then be adjusted to 3500 psi. The nozzle valve is suitable for use without any further repair if it meets the following tests:

1. *Chatter sharply (pop) with the test pump operated at 30 strokes per min.*
2. *Not drip during or after popping.*
3. *With oil pressure slightly less than 3500 psi., note pressure drop. If 15 sec. or more is required for a drop from 3000 to 1000 psi., the needle-to-body clearance is satisfactory for used needles. (New nozzle valve requirements are considerably higher.)*

If the nozzle valve does not pass these tests, further work is indicated.

## Valve Seat Reconditioning

The first two requirements mentioned above relate to valve seat condition. The third is a matter of wear and if the clearance is excessive, the nozzle valve must be replaced. Seat leakage, in most cases, can be remedied.

Re-honing will remove ridges and other deformation of the seat in the valve body. Pencil honing stones are used. To obtain good concentricity of the re-honed seat and bore, the clearance of the mandrel used should not exceed 0.0003 in. on the diameter.

Select a mandrel having the same diameter as the needle, within 0.0005 in. A good micrometer calibrated to read in tenths will permit this. The honing point of the stone is carefully dressed at the factory to an 89-deg. ± 10 min. included angle. Unless facilities are available for dressing to this accuracy, the hones should be returned to the factory for dressing when worn.

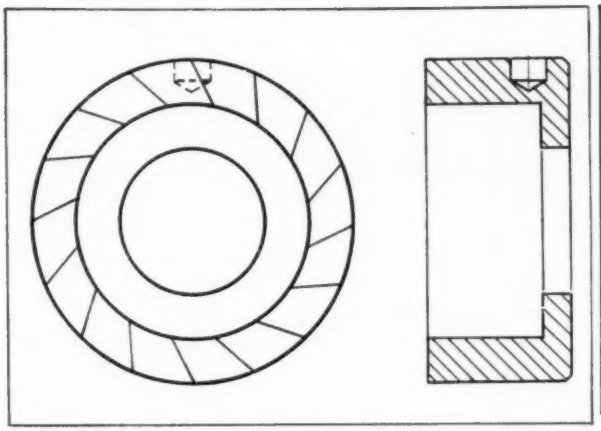
The mandrel is chucked in the proper collet and checked to see that there is no run-out. The shank is lubricated to avoid damage to the bore and lard oil or a similar lubricant is applied to the stone.

Mandrel speeds should be 1750 to 3450 rpm. Honing, however, will take longer at the lower speeds. The valve body is slipped over the mandrel, while stationary, until the stone is in contact with the seat. The mandrel is brought up to speed and then the valve body, held in the hand, is lightly pressed against the stone. Pressure is released after about 5 to 10 seconds and the body slowly rotated before pressure is resumed. The process is continued until the seat, upon visual inspection, is completely refinished.

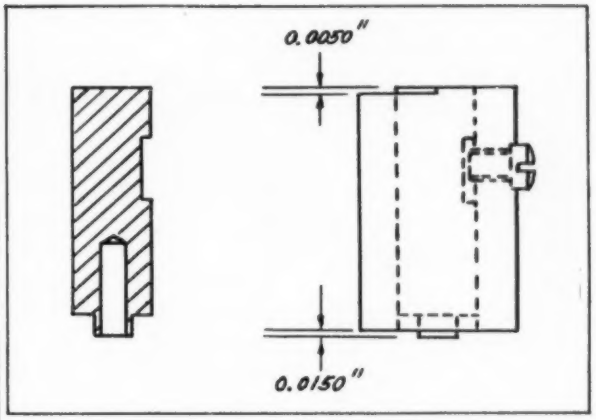
Condition of the seat will be the determining factor in the amount of honing required. It is important to avoid excessive honing as will be pointed out later.

## Needle Seat Reconditioning

While the causes of seat leakage are generally in the nozzle body seat, some needle faces will also become damaged. Honing or lapping of the surface is possible — providing — that facilities are available to reproduce the



*General conformation of the lapping wheel for refacing needle seats. Diameter of about 2¾ in. will give a suitable peripheral speed when mounted on a tool grinder or valve refacer. Lapping face is about ⅜ in. wide. Bore is made to fit arbor of the machine used. Sixteen grooves, tangent to a 1½-in. reference circle are shown. They should be 0.015 to 0.020 in. wide and 1/32 in. deep. Radial bore is for holding wrench.*




*Principle of flush-pin type gauge is shown. Assembly is at right with details of pin at left. Body fits on upper face of valve. Small diameter of needle is accommodated in pin bore so that pin rests on shoulder that limits lift by contacting stop plate. With needle seated and lift proper (0.0150") top of pin is flush with high step. As seat and needle move downward with reconditioning, lift is acceptable (0.0150"-0.020") until pin top is below lower step.*

necessary finish and accuracy of the 90-deg. included angle. A tool grinder or engine valve refacer can be used.

A lapping wheel can be obtained or made in accordance with the accompanying sketch. The interrupted face is charged with green rouge and performs the lapping operation. Such a lapping wheel can be used in place of the stone of a valve refacer. This particular tool is mentioned here since it is felt to be more generally available than tool grinders, etc.

The needle is mounted in the chuck after the fashion of the stem of an engine valve. Care must be taken that there is no run-out or the seat-to-needle axis concentricity will suffer.

The work head of the refacer is set to the proper angle and lapping started. During the early stages, the angular setting can be verified by checking that the lapping wheel makes full contact with the needle face. Avoid excessive lapping.

## Needle to Body Lapping

Check the top end of the needle for burrs or fins. Any irregularities should be removed by careful stoning. The needle can be rotated in a chuck or spindle at a maximum speed of 1750 rpm. during the process and a fine stone used. The lapped surfaces should be carefully protected by wrapping with paper such as a clean paper towel. The upper end of the needle can also be honed if it shows any irregularities.

The needle and valve body should now be lapped together. The needle is held in a collet or chuck by its small diameter, care being taken to insure that it extends out far enough to prevent the lapped face of the nozzle body from striking the chuck. Clearance at least of 1/16 in. should be maintained at all times.

With the lathe stopped, a little green rouge is placed on the cylindrical surface and the valve body slipped over the needle. A combination rotary and back-and-forth motion will serve to distribute the rouge over the surfaces. If the body rotates freely, the lathe is started and the back-and-forth motion continued until the body loosens slightly on the needle.

A thorough washing to remove all traces of the lapping compound is the final act. All of the mechanical reconditioning procedures are now completed.

## Checking Needle Lift

Mention was made of the importance of removing the least possible amount of metal in the honing procedures. Removal of the metal lowers the actual seat location (and needle) in the nozzle body and if the displacement is excessive, it will seriously increase the total needle lift.

Lift should be limited to between 0.015 and 0.020 in. and if this is exceeded, nozzle action and injection characteristics change. A simple flush-pin type gauge (a sketch is shown) is available for determining excessive lift. There is no practical or inexpensive way to correct this condition and thus it becomes a cause for rejection of the nozzle valve.

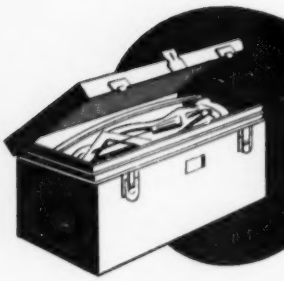
## Final Testing

It will have been noted that there was a nominal difference of a degree in the included angle of the needle face and the seat. If these angles have been accurately reproduced and concentricity maintained, a perfect ring seal should result.

The reassembled nozzle valve, lightly oiled, is again assembled to a holder and spray tip for pop testing. It should now meet the previously stated requirements. In the event that it should still fail, the first step is to make sure that all foreign matter has been eliminated and that the various steps were performed with the greatest accuracy possible. Having this assurance, the needle may be lightly lapped to the seat.

The coarser yellow rouge is applied to the angular face of the needle, taking great care that it does not get on the cylindrical surfaces. Limit the amount of lubrication so that there is no possibility that it might float some

(*Concluded on page* 87)



# Straight from the Tool Box

*This is YOUR Department. Pass along your ideas to the other fellow. Send items to the Editor, preferably with a picture or sketch. Contributors will receive $10.00 for each item upon publication.*

## Eliminating Stray Electrical Currents

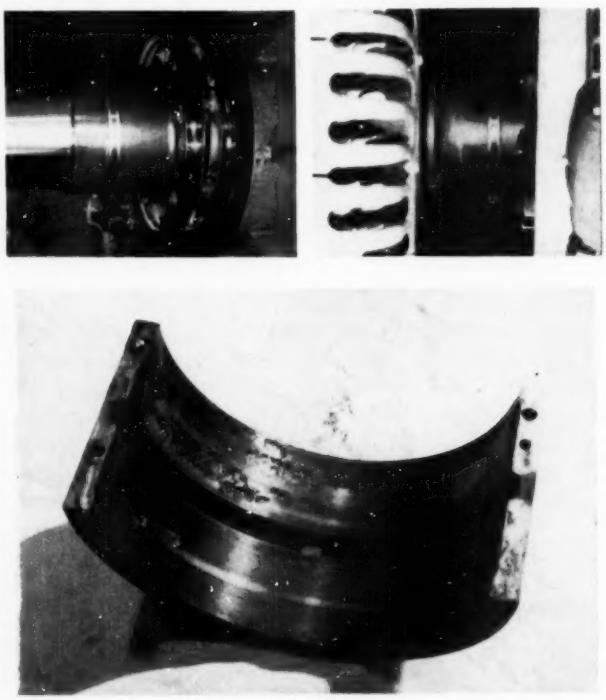
W. O. Tatman, Puerto Rico—Here is a condition that was costing us plenty of money until it was located and corrected. In our diesel power plant we have several large heavy-duty 2-cycle engines.

Shortly after the plant went into operation we noticed that the fuel pump cams were beginning to pit and wear just at the point where the cam began to exert pressure on the fuel pump roller. This gave trouble, on and off, for about two years and then just stopped of its own accord.

On our next annual overhaul we found that some of the lower halves of the main bearing shells were starting to go the same way as the cams had done. On the succeeding overhaul we found that the deterioration of the bearings was progressing very rapidly.

A check of our maintenance records showed that the trouble was always found in the center main bearings and not on the others. The combination of the earlier cam trouble, always in the same spot on the cam, and the specific location of the bearing troubles led us to believe that the troubles were somehow related and not mechanical in nature. Stray electrical currents were suspected.

Two brass collector rings were made up and bolted, one on each side of the generator as shown. The collector ring brushes were wired to ground. This action eliminated any stray shaft currents in the generator and all bearing and cam failures have stopped.



*Grounded collector rings as installed. Above left is ring between generator and pedestal with ring between generator and flywheel at top right. Bearing half illustrates typical condition found.*

(*Shaft currents occur in engine-driven generators under certain design and operating conditions. For a more comprehensive understanding of this phenomenon read "Shaft Currents in Engine-Driven Generators" by A. H. Lauders, General Electric Co.,* Diesel Power and Diesel Transportation, *February,* 1950. *You can't argue with success, but we would like to comment that evidence of shaft currents is generally more localized and will usually show up first in the generator bearings. Good going, and we like that part about checking the maintenance records. Good records: Good operation.—Editor*)

## Removing Carbon Deposits

Frank M. Riggle, Montezuma, Iowa—Everyone in the shop hates the job of removing carbon deposits from cylinder heads, pistons and rings. Some time ago we cut down this hatred by about 75 per cent by using steel wool saturated in fuel oil for this work.

It seems to work very well and the steel wool fits the contours of the parts being cleaned much better than any scraper could. It also does less damage to the surface than the hard scrapers.

One thing to watch is that all the parts are given a good cleaning to remove any of the small particles of steel wool that break off and may stick to an oily surface. Watch where you do the work, too, so that there is no chance of them getting into any moving parts.

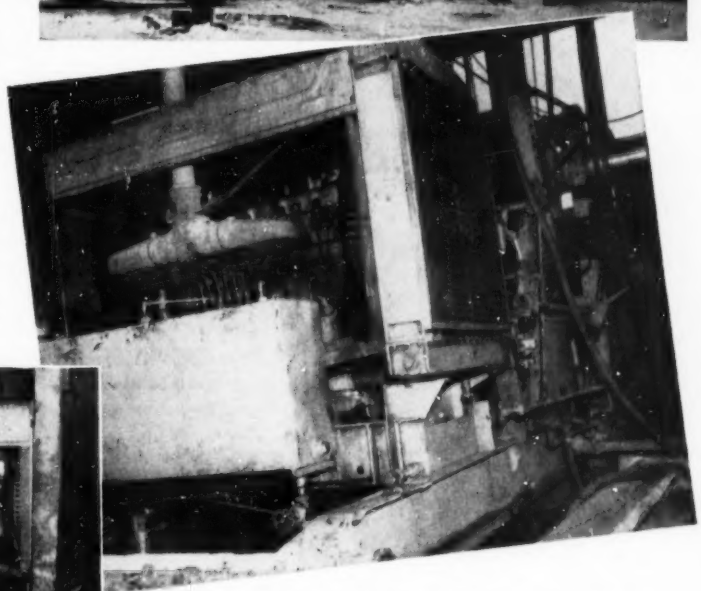
"POWER WHEN I NEED IT"
says Tool Pusher, Harry Knight

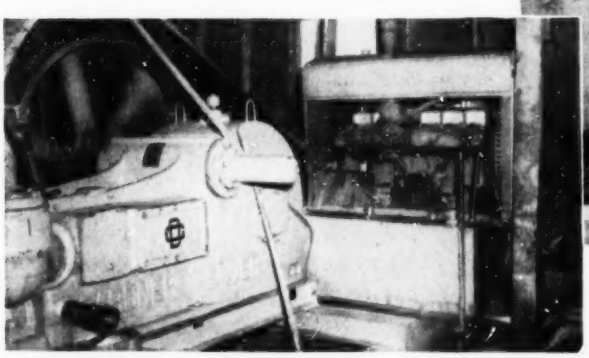
"NEVER ANY DOWN TIME"
says Manager, Herbert Miller
of the NEWPORT DRILLING & SERVICING COMPANY, LTD.

● Just north of Edmonton, Alberta, at Miller Bros.-Campbell No. 1 Well (when the rig was photographed) with temperature at zero—but the Waukesha Diesels kept right on making hole. This well, now going on production, was drilled to 3724 ft. The rig has drilled four holes, three of them producers, or about 35000 ft., in approximately 14 weeks. It's a Model R *Cardwell* with 87-ft., two-pole mast, 7-ft. sub-structure; and a 5 x 10 *Gardner-Denver* mud pump; each powered by a 148-DKU Waukesha Diesel Oil Field Unit.

"These engines give me the power when I need it," says the rig's tool pusher, Harry Knight. And, as Herbert L. Miller, Manager of Newport Drilling & Servicing Co., Ltd., who own and operate the rig, sums it up, "We have never had any down-time due to the failure of these engines and you can be sure that on our next rig we want Waukeshas." Get Bulletin 1414.

**WAUKESHA MOTOR COMPANY, WAUKESHA, WIS.**
NEW YORK • TULSA • LOS ANGELES





Drilling rig (above) and mud pump (left) are each powered by **WAUKESHA Model 148-DKU DIESEL,** 6-cyl., 5¼-in. bore x 6-in. stroke, 779 cu. in. displ.; that burns all "high speed Diesel fuels" cleanly, with lively acceleration, high economy, easier starting.

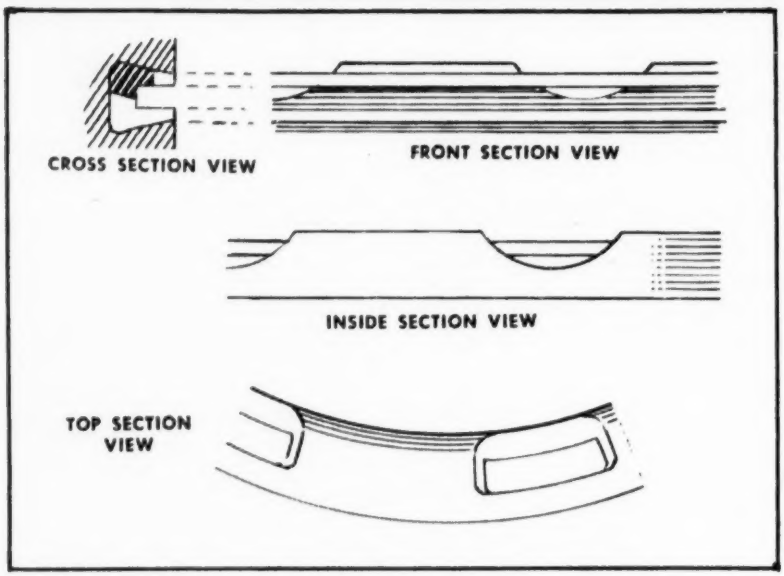
# WAUKESHA

*Diesel Power . . .* *. . . . Gas Power*

# POWER

163

# New Products




*New Zollner Piston*

A new piston has been designed and is now available to engine builders by the Zollner Machine Works, Fort Wayne, Indiana. The new development is the Bondoloc Piston for heavy duty engines where top ring wear has been a problem.

An aluminum piston is cast around a top ring groove section made of "Ni-resist" iron by the Al-fin process, for which the Zollner Company is a licensee. In addition to the metallurgical bond provided by the Al-fin process, a mechanical bond is incorporated in this new design, which makes use of reverse angles on every surface joining the "Ni-resist" iron ring groove section and the body of the aluminum piston by providing a multiple dovetail bond which is infinitely wedge-locked. This double bond is used to insure against the possibility of any separation between the iron ring and the aluminum piston in any service that might be encountered.

In addition to reducing top ring wear, this type of piston permits visual inspection of the bond as seen in the ring groove, and due to the larger cross-sectional area of the iron ring, surface areas carrying inertia loads are increased.

## Automatic Shut-Off Valve To Protect Gages

Production of a new shut off valve designed especially to protect gages in both pneumatic and hydraulic systems is announced by Sprague Engineering & Sales Corporation. The shut off automatically cuts out gages from the system when pressure goes beyond their operating limits, thus protecting them from damage. It automatically opens the gage to the system when the pressure is again within operating range of the gage.

The Sprague shut off is available for low pressure—30, 60, 100, 200, and 300 psi. and high pressure—500, 1000, 1500, 2000, 2500, 3000 and 5000 psi.

## New Lubricant-Coolant For Metal Cutting and Drilling Operations

A new lubricant-coolant development is a new theory in cutting solutions offering greatly increased effectiveness by both free flowing and compressed air application.

Known as "cool-o-lube", it is said to render remarkable results when applied by the Goodyear Pur-o-luber, which is the only equipment of its type recommended for handling this solution.

Its function is that of lubricating and dissipating heat in all metal cutting operations. When used with the Pur-o-luber, the effectiveness of the solution carried by the compressed air stream, said to be many times greater than free flowing coolants, or its own above average results when applied by conventional methods.

This new solution is sold as a concentrate and is basically diluted 1 part solution to 9 parts of water, making consumption economical.

## Dehydrator for Diesel Fuels

Increased combustion efficiency, reduced carbon formation and less corrosion of working parts are claimed for internal combustion engines when using fuel dehydrated by a new unit developed by the Bowser Company, Inc. Dehydration is accomplished by passing the fuel through elements which are a combination of wound cellulose cylinders, specially treated coalescing media, perforated metal and glass cloth. There are no moving parts and with reasonable care the dehydrating units should function indefinitely. In cases where there is a possibility of large volumes of water in fuel, a hydraulically balanced, automatic ejector is available as an accessory.

The new device is available in capacities of 350 and 600 gpm. with a maximum working pressure of 125 psi.

## New Screwholding Screwdriver

A new model screwholding screwdriver was recently developed by Hunter Tool Company to drive small screws in tight, hard-to-get-at places. The long, thin shape and shockproof plastic handle of the new tool makes it ideally suited for electrical, instrument, automotive and aircraft work. To securely fasten the screw to the blade tip requires only a slight push

against the screw slot. This action rotates a hardened steel locking pin in the center of the bladge which firmly locks the blade tip in the screw slot. The steel locking pin extends through the full length of the blade and assures a positive grip that will prevent the blade from slipping out of the slot and marring surfaces surrounding the screw.

### Lead Clad Steel and Copper for High Corrosive Applications

After considerable research, Knapp Mills Inc. announced at the Chemical Industries Exposition that two new metals are now available that, it is claimed, will drastically reduce the enormous waste caused by the corrosion of sulfuric acid.

First of the new metals is Ferrolum, which is made by inseparably bonding chemically lead and steel by an exclusive drawing process in such a way that the finished product combines lead's immunity to sulfuric acid with steel's strength.

Second new metal is Cupralum, and combines lead and copper in a bonding process so as to retain the best features of both metals, particularly lead's acid resistance and copper's high electrical conductivity and heat transfer value.

It is expected that these new metals will be invaluable in saving great amounts of stainless steels, nickel and nickel alloys, high copper alloys and other scarce materials. In addition the use of Cupralum in the plating industry has shown that it is possible to increase up to 1000 per cent the charge which passes from the anode through the electrolyte to the work. This has greatly expedited the hard chrome plating of engine parts, steel rolling mills, artillery and other applications where the deposits of chrome must be dense and heavy.

### Electricians' Continuity Tester—Tool of Many Uses

A new pocket-size continuity tester is being added to the line of electricians' tools manufactured by Ideal Industries, Inc.

The new tester is designed to determine continuity of circuits and identify wires between terminal or in multi-wire cable, as in switchboards and control panels.

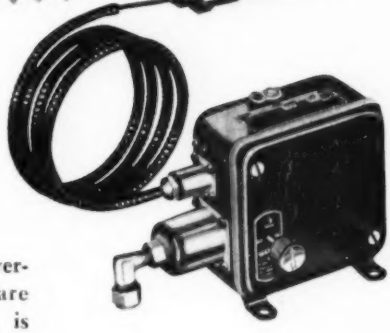
No longer than a pen-lite flashlight, it supplies it own power from pen-lite batteries, making it possible to test circuits without the need of live wire connections, uses a signal light indicator so that it can be used in noisy areas, and requires only one hand for its use, leaving the other free to hold circuit diagrams or blueprints.

All testers come equipped with a four-foot cord and alligator clip. When not in use the test lead is detached eliminating any chance of exhausting the batteries.

### New Hydraulic Power Package for High Pressure Work

Production of a new, hydraulic power package for oil or water service is announced by Sprague Engineering & Sales Corporation. The model, S-440, is applicable for a wide variety of uses where low volume output at high pressure is the requirement such as in hydrostatic testing, etc.

**CAN PREVENT ENGINE BREAKDOWN**



IF . . . at the first hint of engine overheating or oil failure . . . you are *warned* or the engine operation is *stopped* immediately, then you can investigate and correct the fault before major *damage occurs.*

And that's exactly what the PENN Safety Control does . . . *automatically.* Every second, day and night, the PENN control "watches" so that overheated cooling water or oil pressure failure can't result in damage to your engines!

Learn more about this low-cost protection for *new and old engines.* Write **Penn Controls, Inc., Goshen, Indiana.** Export Division: 13 East 40th Street, New York 16, N. Y., U. S. A. In Canada: Penn Controls Limited, Toronto, Ontario.

***Typical Functions of PENN Safety Controls***

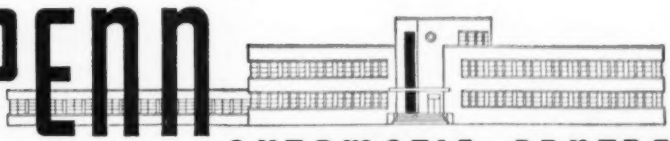
**Diesel Applications.** Sounds an alarm . . . closes magnetic fuel valve and sounds alarm . . . closes magnetic fuel valve only . . . closes magnetic fuel valve and opens pilot relay.

**Battery Ignition Applications.** Opens battery circuit and sounds an alarm . . . sounds an alarm only . . . opens battery circuit only.

**Magneto Ignition Applications.** Sounds an alarm only . . . grounds dual magneto . . . grounds magneto only . . . grounds magneto and sounds alarm or lights signal light.

**Dual Ignition Applications.** Opens battery circuit and grounds magneto.

**PENN**



**AUTOMATIC CONTROLS**

FOR HEATING, REFRIGERATION, AIR CONDITIONING, PUMPS, AIR COMPRESSORS, ENGINES, GAS RANGES

The power package is simple to install, and requires only two connections—one to plant air supply line and the other to a manifold, etc., from outlet fluid port of the power unit. Containing all necessary equipment, including air operated pump, air muffler, air filter, air lubricator, air regulator, valves and gauges, the device is mounted on an easy-to-carry masonite base and weighs 45 lbs.

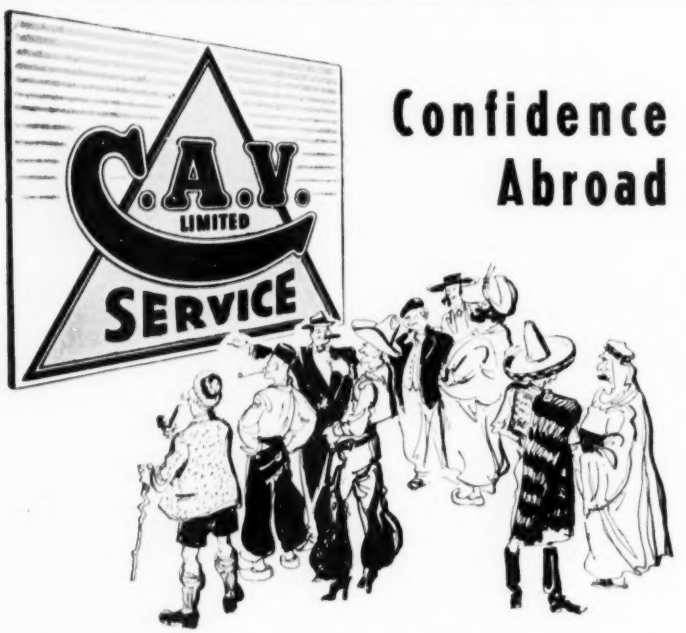
Heart of the power package is the Sprague Model 216-c pump, which operates automatically on the principle of differential areas. It is furnished in six standard models with ratios of from 35:1, 60:1, 100:1, 150:1, 200:1 and 300:1, making possible an output range from 3500 to 30,000 psi.

## New Parts Cleaning Machine

Introduced recently by the Equipment Division of the Magnus Chemical Company is the new Magnus Aja-Lif parts cleaning machine for the cleaning of automotive, truck, and bus engine blocks and disassembled parts.

Powered by compressed air, the new device has a movable platform that is controlled by an operating lever. The platform is raised to the top of the tank for loading and unloading work and then lowered into the tank where it is automatically agitated up and down in the cleaning solution, shearing the dirt from the parts. This, it is claimed eliminates all hand brushing and scrubbing.

These machines are available in three sizes and solution heating can be by gas, steam, or electricity.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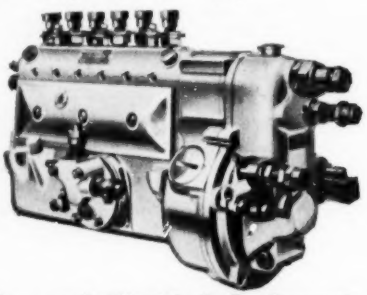
***Transport operators all over the world have learnt to trust this sign.***

In any language the letters on the C.A.V. sign stand for first-rate service facilities, maintained by highly-trained craftsmen, using special precision equipment.

Wherever vehicles fitted with C.A.V. Fuel Injection Equipment are exported — whether to Trondheim, Santiago, Hong-Kong or Sydney—there's a service agent or depot to give it the specialist attention needed for such high-precision equipment.



C.A.V.

**Fuel Injection and Electrical Equipment**

***Service Depots throughout the World***

C.A.V. DIVISION OF LUCAS ELECTRICAL SERVICES INC., NEW YORK 19, N.Y. Sales Office: 14820 DETROIT AVE., CLEVELAND 7, OHIO


## Two New and Two Improved Lubricants Announced by the Texas Company

### High Temperature Grease

A new high temperature anti-friction bearing lubricant, known as Texaco High Temp Grease, is claimed to extend the range of operation of ball, roller, and plain bearings at high temperatures. Protection is afforded at temperatures up to 300° F for continuous operation and to 350° F for intermittent operation. The new grease is said to perform well at high speeds and has high resistance to water washing and oxidation.

### Multi-Purpose Grease

An improved multi-purpose grease known as Texaco Multifak 2 Grease has been placed on the market for use in situations which require a high grade multi-purpose grease for a variety of operations. The new lubricant is said to have good shear stability, excellent resistance against water washing, and good pumpability at low temperatures. It is also claimed to be suitable for bearing lubrication over a wide range of operating temperatures.

### Rail Joint Lubricant

Another lubricant Texas recently introduced is the Texaco Rail Joint Lubricant. This is a rust preventing lubricant which can be spray applied regardless of moisture conditions. It is a blend of straight mineral oil and a special additive which imparts unusual adhesiveness and water resistance, minimizing the hazards of rail

misalignments and failure of signal systems due to frozen joints.

### Wire Rope Lubricant

An improved wire rope lubricant, known as Crater A, it is claimed can be applied to wire rope even though wet, because of its unusual penetration and adhesion properties. Field tests have indicated, that the compound is especially valuable for use in severe weather conditions or where the cable is subjected to abnormal water conditions in use. It is a thin liquid, which can be applied without heating, and will remain pliable under a wide range of atmospheric conditions.

## Improved Chronometric Type Tachometer

An improved Jaquet speed indicator with new ball bearing spindle and new dial with extra scale divisions, which greatly increases readability of these chronometric type tachometers has been announced by the Herman H. Sticht Company, Inc.

Guaranteed accuracy of these instruments is ½ of one per cent. Four different models are offered, covering extreme low speeds with readings possible to 2/100th of 1 rpm. per division, and maximum readings to be taken up to 100,000 rpm. The instruments are furnished in three differents styles of cases with different sets of accessories to suit many different applications.

Being of the chronometric type these speed indicators measure rpm. over a fixed period of three and six seconds respectively, after which the hands stop. The indicators are pocket size and are ideal for spot checks of rpm. or ft. per min. in all cases where speeds remain fairly constant over three to six seconds.

## New Compound For Setting Anchor Bolts

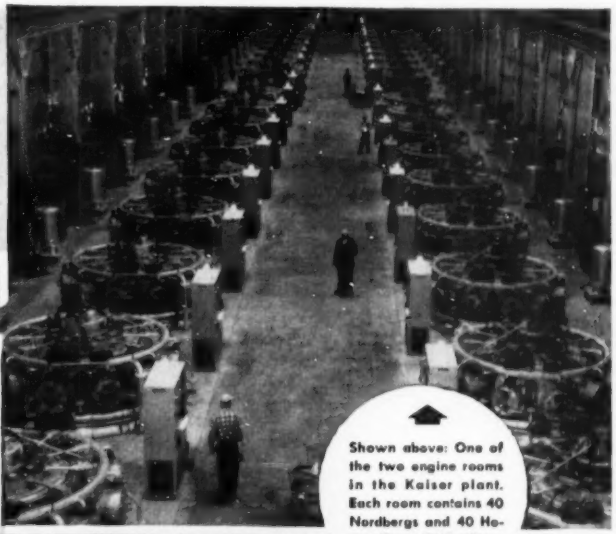
Anchor bolts for permanently fastening machinery or equipment of any type to concrete, can now be set easily


**Honan-Crane**

**Oil Purification**

**...first choice to protect all 80 Nordberg Diesels at Kaiser Aluminum's huge new Chalmette Plant**

In the giant Kaiser Aluminum and Chemical Corp. plant 80 Honan-Crane Oil Purifiers maintain a continuous supply of clean, safe cylinder and crankcase oil for 80 eleven-cylinder, 1820 HP Nordberg gas engines. Again, experienced diesel engineers have specified *Honan-Crane* for safe, dependable protection against breakdown and excessive wear due to contaminated oil! Honan-Crane Oil Purification (for either inhibited or straight mineral oils) protects bearings, cylinder walls and other finely machined parts from improper lubrication and costly damage often caused by solid abrasive contaminants or by acids, gums, resins and other products of oxidation. Write today for complete information about Honan-Crane Fuel and Lube Oil Purifiers.



Shown above: One of the two engine rooms in the Kaiser plant. Each room contains 40 Nordbergs and 40 Honan-Crane Oil Purifiers.

WORLD LEADING OIL FILTER MANUFACTURER

**Honan-Crane Corp.**

305 Wabash Ave., Lebanon, Indiana

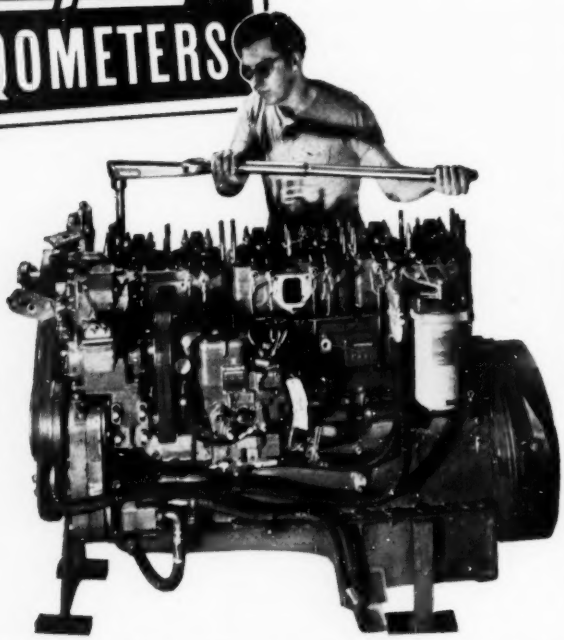
*A Subsidiary of*

**Houdaille-Hershey Corporation**

# Cummins® Diesels

## ARE PRECISION TENSIONED WITH

**Snap-on* TORQOMETERS**



**Each Cummins Diesel is built not once, but twice.**

One of the big reasons for the high reputation of Cummins Diesels is the *extra* care Cummins uses in building its engines. For example, each Cummins Diesel is run in after assembly, then completely disassembled for reinspection. Then it is carefully reassembled and tested again. In *both* assembling operations, Snap-on Torqometers are used to assure complete accuracy of tensioning.

When precision machinery is assembled with bolts, mechanical distortion and excess wear of moving parts often occur if bolts are tightened to unequal or improper tension. To insure correct bolt tensioning, use Snap-on Torqometers . . . accurate as a watch, yet so easily read that even inexperienced workers can use them.

Snap-on Torqometers are built in 15 standard models, capacity from 0 to 30 inch-pounds up to 2,000 foot-pounds. At-your-elbow service from factory branches in 42 important industrial centers. Write for the Snap-on Industrial Catalog and the 104-page General Catalog of more than 4,000 Snap-on hand and bench tools for production and maintenance.

**SNAP-ON TOOLS CORPORATION**
**8064-B 28th Avenue**
**Kenosha, Wisconsin**

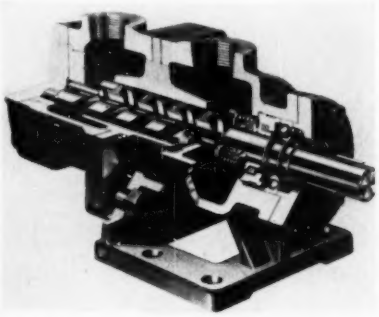
*Snap-on is the trademark of Snap-on Tools Corporation


and quickly it is claimed by using a new compound developed by the Hallemite Manufacturing Company.

Known as Por-Rok, it is designed to replace critical lead and sulfur for most bolt-setting operations. To apply the new product, it is only necessary to mix with water, and pour mixture into hole around the bolt. Setting takes 15 to 30 minutes and there is no shrinkage.

### New Low-Cost IMO Pump

A new De Laval-IMO A313B pump which makes possible appreciable savings in initial cost over other IMO



models for similar pressures has been announced by De Laval Steam Turbine Company, Trenton 2, New Jersey. It is designed to handle a wide variety of oil handling applications for pressures up to 275 psi.

This new rotary positive displacement pump has only three moving parts and is quiet, pulsation-free, compact and excellent for high speed operation, it is claimed. It can be used for capacities to 80 gpm., pressures to 275 psi. and intermittent pressures up to 325 psi. It handles light or viscous fluids in hydraulic systems, rotary and steam atomizing oil burners, lubrication, governing systems and similar services.

### Automatic Transmission on Trucks

A fully automatic transmission has been placed for the first time in a commercial model truck, it was announced recently by the GMC Truck & Coach Division, Pontiac 11, Michigan, in the introduction of a new parcel delivery unit.

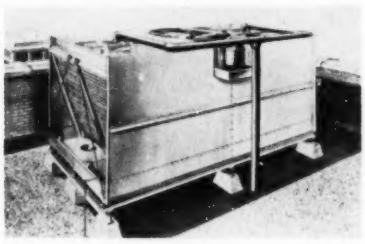
The new truck has the dual-range hydra-matic drive as standard equipment, providing three speeds for city driving and four for suburban or

country driving. The new parcel delivery, designated as the P152-22 was shown publicly for the first time at the Chicago Automobile Show, February 16-24, as part of the GMC truck exhibit.

GMC placed the hydra-matic drive last year in the new M-135 6 by 6 military truck which has been in production since last September.

### New Double-Flow Aquatower

A new double flow cooling tower has been introduced by The Marley Company for use wherever intermediate capacities of cold water are required. Cooling towers in this range are widely used in the power, petroleum, gas chemical processing, food processing and metal working industries, and wherever air conditioning and refrigeration are used.



Some of the outstanding features claimed for the new design are compactness, low pumping head, fan hp., and simplified inspection and maintenance.

Contact The Marley Company, Inc., 222 W. Gregory Blvd., Kansas City, Mo.

### Four Design Improvements For G-E Switcher

Improvements designed to reduce maintenance costs and increase availability have been announced for the 1952 model of General Electric's 70-ton, 600-hp. diesel electric switching locomotive.

Among the new model's four design changes is the replacement of the former single-stage water-cooled air compressor with an air-cooled 2-stage belt-driven compressor. Company engineers add that simplified piping, higher efficiency and cooler operation are advantages of the new compressor.

New power contactors have been installed to increase the continuous rat-

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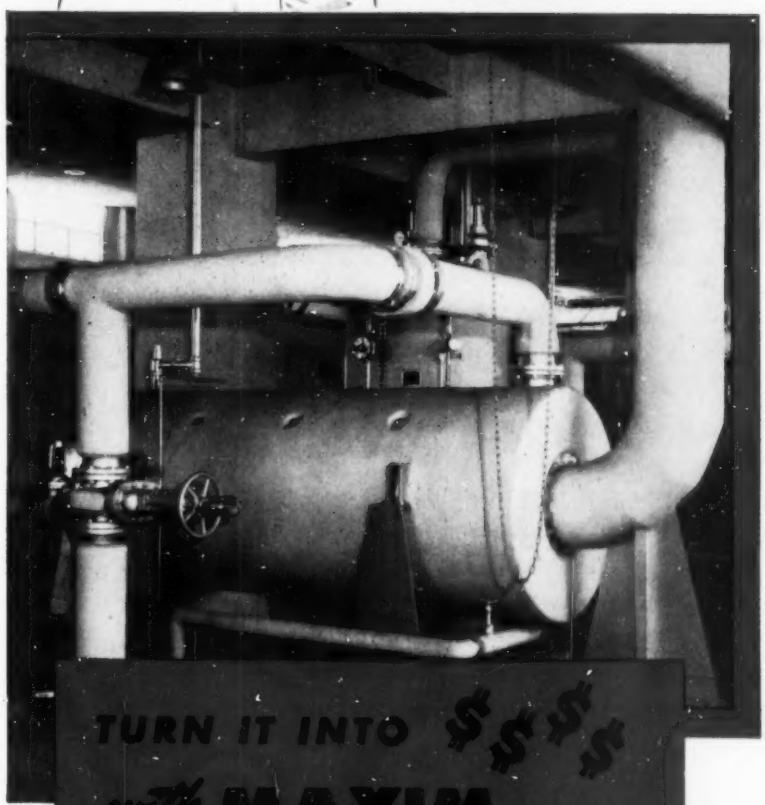

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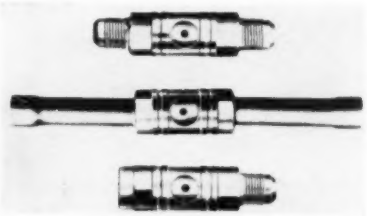
ing and triple the contact life. The contacts are designed to be resistant to welds, and the new contactors also have non-bouncing armatures.

A single relay replaces the original two types of transfer relays, resulting in the elimination of two interlocks in the high voltage circuit. The number of parts needed for maintenance has thus been simplified by using identical relays for shunting and transition control.

Simplification of gage panel parts and rearrangement of the gage panel also highlight this new G-E railroad locomotive model.

## Visual Flow Line Indicator

A simple, positive and inexpensive flow indicator for oil pressure lines, diesel fuel oil lines, refrigerant or chemical lines, etc. has been recently placed on the market by the Allin Manufacturing Company, 1153 West Grand Ave., Chicago 22, Ill.



The indicator is incorporated into the line and permits instant visual inspection without the necessity of reading pressure gauges. Known as "the liquid eye", this new indicator consists of a brass housing in which is inserted a transparent high pressure Pyrex tube with a ceramic eye which visually magnifies when the liquid line is full.

The "straight through" design eliminates pressure drop and construction is such that it is not affected by the most commonly used chemicals, solutions and oils.

Three styles are available in copper tube sizes of ¼-, ⅜-, ½- and ⅝-in. with male flare ends, female to male flare ends with copper flare insert in the female end, or with solder connections.

## A-C Introduces Motor Graders

Two completely new motor graders —models AD-40 and AD-30—were an-

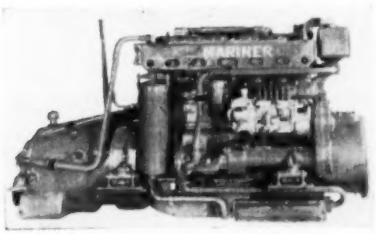
nounced recently by the Tractor Division of Allis-Chalmers Manufacturing Company, Milwaukee, Wisconsin. These newly designed machines complete a line of five motor graders having a wide range of horsepower, weight and speed.

The 4-cyl., 2-cycle, diesel-powered AD-40 weighs 23,000 lbs. and develops 104 brake horsepower. The AD-30 is powered by a 3-cyl., 2-cycle diesel engine, weighs 22,700 lbs. and develops 78 brake horsepower.

Engines are General Motors 2-cycle diesels and will handle the heavy-duty power requirements of any job. Tandem drive offers full traction under any ground conditions.

### Truck Diesel Adapted to Marine Use

Under an agreement just concluded between Mack Trucks Inc., New York,



N. Y. and the Palmer Engine Co. of Cos Cob, Conn., the Mack Co. will manufacture the basic engine and the Palmer Co. will adapt it to marine use.

Known as the Palmer "Mariner", it is a 4-cycle engine, with 140-hp. at 1800-rpm. for intermittent service and 120-hp. at 1600 rpm. for continuous service.

### New Governor Design Adaptable to Alco-GE 1600-Hp. Locomotives

An improved locomotive governor which has been installed on Alco-GE 1600-hp. road locomotives for the past year may now be installed on earlier model locomotives through the use of an adapter kit.

The latest model governor is high lighted by simplified electrical components and fewer moving parts. Nearly all expendable parts of the new governor are completely interchangeable with corresponding parts of the former design. The speed pilot valve and the fuel limit pilot valve have been made identical in design so that separate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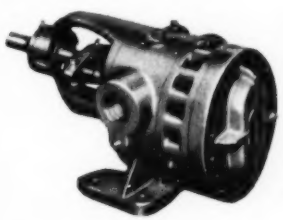
SPEEDS UP TO 1800 R.P.M. FOR PUMPING CLEAN LIQUIDS

SERIES F

Four-port design offers 8 optional piping arrangements. Equal size helical gears run in axial hydraulic balance. Standard or bronze fitted; packed box or mechanical seal. Up to 300 P.S.I.—1 to 300 G.P.M. for clean liquids.

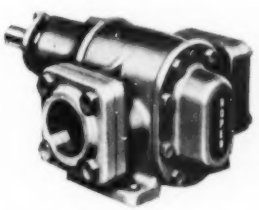


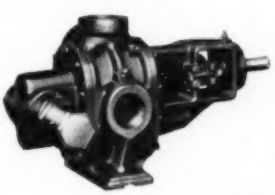
SERIES H

Widely used for hydraulic mechanisms and other applications where high pressures are required. Spur gears provide high volumetric efficiency. Packed box or mechanical seal. Pressures to 1000 P.S.I. — 5 to 75 G.P.M. sizes.

SERIES K

For hydraulic service, fuel transfer or fuel supply. Features helical gears and exclusive Venturi suction and discharge principle in 10 through 50 G.P.M. sizes. Packed box or mechanical seal. 150 P.S.I. — 3/4 to 50 G.P.M.





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For general purpose work handling thin or thick liquids with suction lift up to 15 feet. Standard or bronze fitted; with or without built-in relief valve. Pressures to 60 P.S.I. — 40 to 300 G.P.M.

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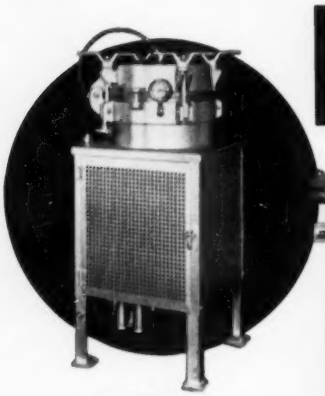

OIL RECLAIMER

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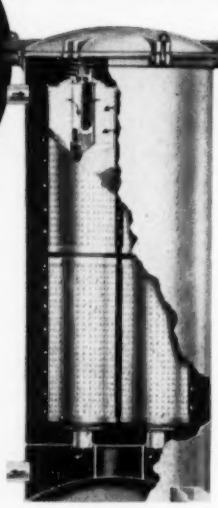

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renewal parts stocks are no longer necessary. The valves may now be removed from the top of the governor as a unit.

External piping has been reduced by building the oil reservoir into the base of the unit, thus eliminating the separate oil reservoir formerly mounted on the floor of the locomotive. A visible reservoir sight glass replaces the old dipstick method of checking oil.

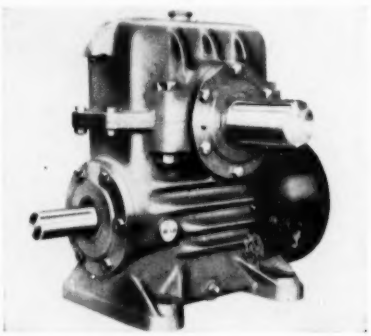
Electrical wiring has been simplified through the elimination of the governor-off switch, its function being served by another switch in the circuit.

## New Line of Speed Reducers

A new line of worm reduction gears, known as the Crofts "Radiation" speed reducers has been announced by the National Transmission Distributors, Inc., 684 Broadway, New York, N. Y.

A variety of ratios from 5 to 1 through 100 to 1 and from fractional up to 400 hp. is offered.

The smaller units (1⅛, 1¾ and 2¼ in dia.) feature universal mounting



for worm on bottom, top or vertical installation. While delivery is made with assembly as specified, legs are removable and can be mated to other holes in housing to permit varied mounting.

Ten sizes ranging from 3½ through 14 in. are all fan cooled.

## Resistance Thermometers for Industrial Field

A new mechanism that makes possible the use of resistance thermometers for industrial temperature measurement and control was described recently at the Winter Meeting of the American Institute of Electrical Engineers at the Hotel Statler in New York.

The instrument has high sensitivity, high accuracy, is of sturdy construction, is legible, simple and is versatile, according to its manufacturer, the Meter and Instrument Dept., General Electric Co., West Lynn, Mass.

Resistance thermometers have been widely used in standardizing work in thermometry and for aircraft temperature measurements, but have not been used extensively in industry, primarily because instruments which combine high sensitivity, simplicity and sturdy construction have not been available heretofore, it was said. Resistance thermometers have several advantages over other types, in that they are inherently stable and accurate, and the "end device" may be several hundred feet from the primary detector without affecting accuracy.

### New, Non-Toxic Dy/Chek Formula

Completion of a new, improved and non-toxic Dy/Chek formula was recently announced by Turco Products, Inc., manufacturers of the dye penetrant inspection process.

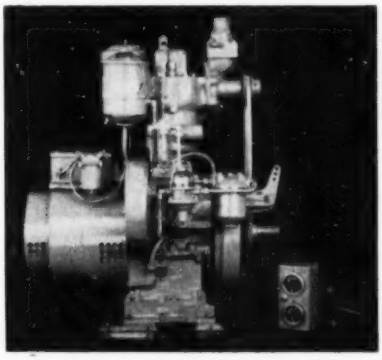
Inspection by the Dy/Chek process is basically a "hide and seek" process. After a thorough pre-cleaning, a red dye is applied to the surface being inspected. Sufficient time is then allowed for the dye to locate any flaw or defect that extends to the surface, after which it is removed. A white developer is then applied to the surface being inspected. This developer "seeks" out the dye "hidden" in the flaw, and as the developer dries, it pulls the "hidden" dye to the surface. The red dye thus bleeds into the white developer, marking with photographic clarity any defects, as well as their extent, that may be present.

Advantages claimed for the process are its relative cheapness to other methods, no special equipment or licensing fee required, applicable to both ferrous and non-ferrous metals, portability and accuracy.

Contact Turco Products, Inc., Terminal Annex 2649, Los Angeles 54, California.

### New 2-KW. Generating Set

Sheppard diesels, Hanover, Pa., announces the addition of a new 2-kw., light weight, generating set to their line of full diesel engines and farm tractors. Tests which the company has been conducting for the past year are now completed and the new generating set is ready for distribution. It has a capacity of 2000 watts at 1800 rpm. and is available in ac. as well as dc. and in all standard voltages.



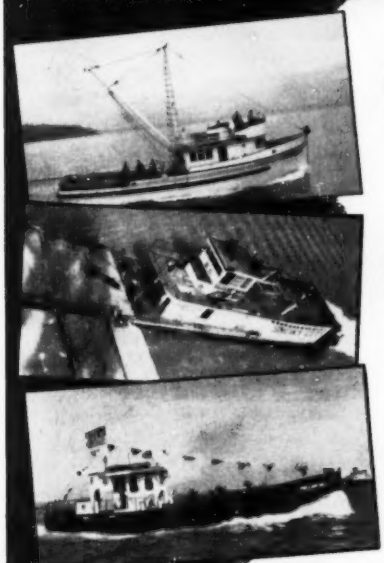
## New Literature

### Flow Meter Bulletin

A new 40-page bulletin describing the "Series 500" line of flow meters has been published by The Bristol Company of Waterbury 20, Connecticut.

The bulletin, No. F1605, describes instruments for recording, integrating, indicating, automatic controlling, and telemetering the flow of steam, water, air, gas, oil, solutions, and other fluids. Both mechanical and electric type flow meters are described in a full range of models suitable for a wide variety of uses in industrial plants, utility companies and process control work. Complete information is given on the various types of meter bodies, operating principles, primary devices for flow measurement, recording charts and accessories.


**Lives and Livelihoods DEPEND on S-N GEARS**



**for DEPENDABLE POWER TRANSMISSION**

"We take great pride in our boat and equipment," says Frank Ivanovich, an owner of the "Maria Rose." First of the unlimited Alaskan Seiners with S-N Gears, it is now in its 4th year of flawless service. A 150 H.P. Lorimer Diesel, and S-N Gears with superior cone type clutch, was their choice.

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"For river and towing work, S-N Gears make a boat more dependable than with two-way engines," states Glenn M. Crain, owner of the "Smoky City," Pittsburgh. This stern paddle wheeler's Caterpillar Diesel is complemented by S-N air-controlled Gear that transmits power instantly and simplifies maneuvering.

**for DEPENDABLE PERFORMANCE**

"Tide work around wharfs makes it necessary to have a dependable reverse gear on our 135 H.P. Murphy Diesel," says R. A. MacLean of Harbor Supply Oil Co., owner of "Portland Gulf." S-N's balanced gear train assures long, trouble-free service under every condition.

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*Specify* S-N GEARS

Designed with features specifically for marine use.

WHAT'S THE BEST WAY TO STRIP PAINT FROM METAL PARTS TOO LARGE TO BE SOAKED IN TANKS?

See Page 3

**Oakite's New FREE Booklet on Paint Stripping**

answers many questions that will lead you to better stripping procedures. You'll want to read more about:

**What's the best way to strip large areas of structural metal where a steam supply is available?** *See page 5.*

What is the best method when steam is not available? *See page 7.*

**What is the cheapest way to strip metal parts in large volume?** *See page 9.*

What are the best ways to prepare stripped surfaces for repainting? *See page 11.*

**What strippers are best for removing oil-base paints? . . . Synthetic enamels, alkali-resistant plastics or resin-based paints? . . . Japans, wrinkle finishes, nitrocellulose lacquers, alkyds, phenolics and ureas?** *See page 12.*

**FREE** For a copy of "How to STRIP PAINT" write to Oakite Products, Inc., 23A Thames St., New York 6, N. Y.

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### Cooper-Bessemer Bulletin

Complete engineering data covering Cooper-Bessemer's type-M line of motor-driven compressors is now available in a new bulletin. Compressors described range from 250 to 1000 horsepower with standard two-stage units and 300 to 1000 horsepower with standard single stage units.

Write The Cooper-Bessemer Corporation, Mount Vernon, Ohio. Ask for bulletin M-65.

### Power Plant Packings Folder

Johns-Manville, 22 E. 40 St., New York 16, N. Y., has issued a 6-page folder entitled, "Packings for the Power Plant". Designed as a quick reference aid, one of the features is a flow sheet of a rudimentary industrial power plant with each unit keyed to the proper packings and gaskets. These, in turn, are illustrated with close-up photographs followed by short paragraphs giving construction information, sizes and similar pertinent data. In addition, the packings and gaskets are grouped on the pages according to the applications and services for which they are recommended. Where packings have more than one application, cross-references are supplied in the text.

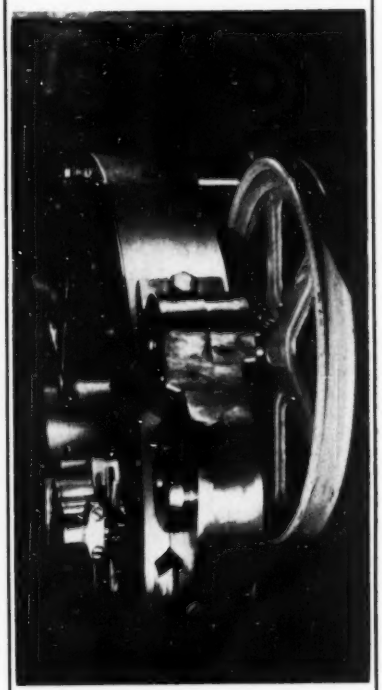
### Centrifugal Pump Instruction Booklet

An instruction booklet covering the installation, operation and repair of single-stage, double-suction Allis-Chalmers centrifugal pumps has been released by the company. It recommends that a regular inspection be followed and includes a maintenance timetable which is based on continuous pump operation and which serves as a reliable pattern for all practical purposes.

One page of the booklet is for use as a permanent record of the operator's pump and of its performance. It is so arranged as to enable the operator to see at a glance the life of any parts replaced and any improvement due to substitute materials. It also carries a reference guide which lists 40 possible causes of trouble in pump operation and their cures.

Copies of the booklet, 08X7613, are available upon request from Allis-

**CRANK PINS *REFINISHED* IN PLACE**



**Our crank pin turning machines — designed and developed along with the Diesel Industry — are available to save you time and expense.**

**We are repeatedly effecting great savings for our customers throughout North and South America with this complete line of portable equipment.**

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Pure aluminum or any of its alloys can be bonded to cast iron, carbon steel, high alloy steel, stainless, inconel and many others. Heat treatment after bonding is possible.

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Chalmers Manufacturing Company, 960 S. 70th St., Milwaukee, Wisconsin.

### Instrument Brochure

Minneapolis-Honeywell Regulator Company, Brown Instruments Division, Wayne and Windrim Avenues, Philadelphia 44, Pa. has issued a booklet entitled "Tomorrow is Today".

This booklet is the outgrowth of a private showing for N. P. A. and other government agencies at Washington of new and improved instruments. It is a picturization of the industrial instrument story, showing the importance of instruments to industry — defense and general.

### Electronic Release

A new 6-page illustrated data release titled "Electronic Transmission and Control" has been issued by the Swartwout Company.

The brochure explains the autronic principle and how the autronic control system utilizes electronics for automatically measuring and controlling process variables such as temperature, pressure, level and flow.

Punched for filing in a three-ring binder, the release illustrates the components of the system and shows a unit installation. A system circuit diagram is included along with a discussion of a typical application. Copies can be obtained by writing to the company, 18511 Euclid Ave., Cleveland 12, Ohio, and asking for data release A-703.

### Nordberg Brochure

Design and operation features of the Nordberg one, two and the recently introduced three cylinder type 4FS diesel engines are illustrated and described in a new 12-page, two-color bulletin published by Nordberg Manufacturing Company, Milwaukee 1, Wisconsin.

Built for continuous duty or standby service, the engines described have a 4½-in. bore and 5¼-in. stroke and are of the 4-cycle, vertical mechanical injection type. The units range from 10 to 45 hp. within an operating speed range of 1200 to 1300 rpm. They are complete, self-contained, ready to operate units with generator, pump or


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FOR POWER TRANSMISSION REQUIRE NO MAINTENANCE

**Patented Flexible Disc Rings of special steel transmit the power and provide for misalignment and end float.**

Thomas Couplings have a wide range of speeds, horsepower and shaft sizes:
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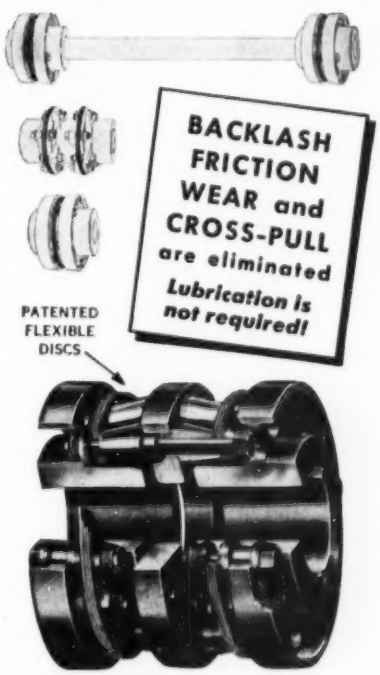


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power takeoff for direct connection or belt drive. The bulletin gives kilowatt ratings and pumping capacities of the various models.

Bulletin 194 is illustrated with installation photographs of typical applications of the engines and with cross section views showing construction features. Pictures show all main engine parts and complete engine specifications are given.

### Brown & Sharpe Catalog

Brown & Sharpe Manufacturing Company, Providence 1, Rhode Island, has issued a new catalog (No. 35).

The catalog contains 224 pages and presents the complete line of small tools, machinists' tools, electronic measuring equipment, gages, Johansson gage blocks, milling cutters, hobs, arbors, adapters and collets, screw machine tools, pumps and other shop items including ground flat stock, vises and permanent magnet chucks.

Included with the catalog is a copy of the new price list containing a new ordering system which establishes product identification of every item in the catalog, regardless of type, size, style or variation.

### Conveyor Catalog

A new 24-page illustrated book No. 2444 on positive action oscillating conveyors for conveying, feeding, cooling, screening a great variety of loose bulk materials, is announced by the Link-Belt Company, 307 N. Michigan Ave., Chicago 1, Illinois.

The book includes dimensions, weights, and capacity and horsepower charts on torsion mount oscillators for heavy duty as well as for the recently announced "flexmount" oscillator for the lighter-duty applications.

The book shows the handling of shakeout sand, food products, cement clinker, metal chips, hot mineral sands, hot castings, silicon carbide and cullet. Among other bulk materials listed are coal, ores, chemicals, wood chips, etc.

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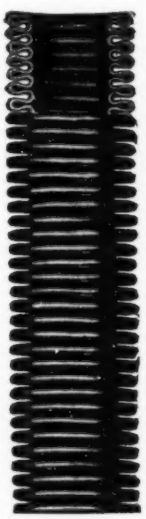
Absolute uniformity of wall thickness . . . no seams or packed joints . . . absolutely tight against water, oil, steam, gas, air . . . dampens vibration . . . . maintains flexibility at extremely high temperatures.

**Bronze, Steel, Stainless Steel, Monel — ⅛"—36" I.D. with fittings as needed.**



Diesel Bulletins 1020 & 50A furnish complete information.

**See our Catalogs in Sweet's Files for Product Designers and Mechanical Industries.**

**ATLANTIC**

**METAL HOSE CO., INC.**

**109 West 64th St.,**

**New York 23, N. Y.**


## "Cat" Diesel Catalog

A close look at mechanical features is provided in a new catalog entitled "Caterpillar Diesel D2 Tractor."

Subject of the catalog is a 32 drawbar horsepower machine with many applications in agriculture, construction, logging, mining and other fields. Its purposes include general tractor power for the average owner and an extra "hand" on odd jobs for the larger operator.

Part-by-part, the catalog explains how the machine is built, what it's like and how it performs. Typical jobs are shown, along with reports from actual owners. More than 60 pictures are included in the 32-page presentation.

Copies may be obtained from Caterpillar Tractor Company, Peoria, Illinois. Ask for form No. 30284.

## "Servomechanisms" Primer

The complex electronic "brains" which control modern armaments are elaborate combinations of simple control devices, called "servomechanisms" or "servo systems". To develop competent service men for these mechanisms the Navy has prepared a "service-man's primer" on servomechanisms which is now made available to the public through the Office of Technical Services, U. S. Dept. of Commerce, Washington 25, D. C. Ask for PB 104 386, Instrument Servomechanisms, and enclose $2.00 in check or money order made payable to the Treasurer of the United States.

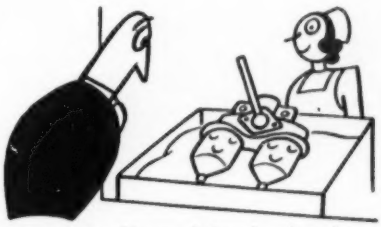
This book presents the basic terms and definitions used in the field, explains the major components of the systems, the basic operation phenomena, and the characteristics of these systems. It describes briefly the principal types of such systems in general use and the more widely used component elements.

The 265-page text includes diagrams, tables, photographs, and graphs. It is devoted exclusively to those servomechanisms used for automatic positioning. Other common types, such as those used for automatic flow control in industrial processing plants, are omitted.

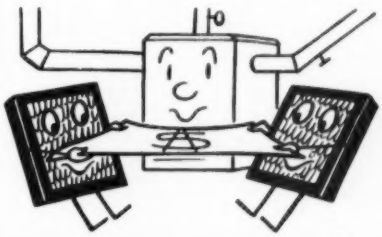

**AIR-MAZING FACTS**

BY O. SOGLOW

**ATOM DUST CLOSES PHOTO PLANT!** Radioactive dust from an atomic explosion in Nevada, carried cross-country by air currents to a Rochester, N. Y., photo film factory, "exposed" and ruined a large amount of stored film there, causing the plant to shut down for 36 hours.



**IT'S TWINS!** No need for shutting down production when oil line filters need cleaning. With a new Air-Maze duplex oil filter on the job you can clean one "twin" at a time, while oil continues to flow through the other.



**DUSTAY® STRETCHES FUEL DOLLARS!** Dirt-clogged filters in your furnace block off air, make your furnace work overtime and use more fuel. Stretch your fuel dollar by replacing dirty filters with new Dustays—the disposable filters that hold more dirt without clogging.

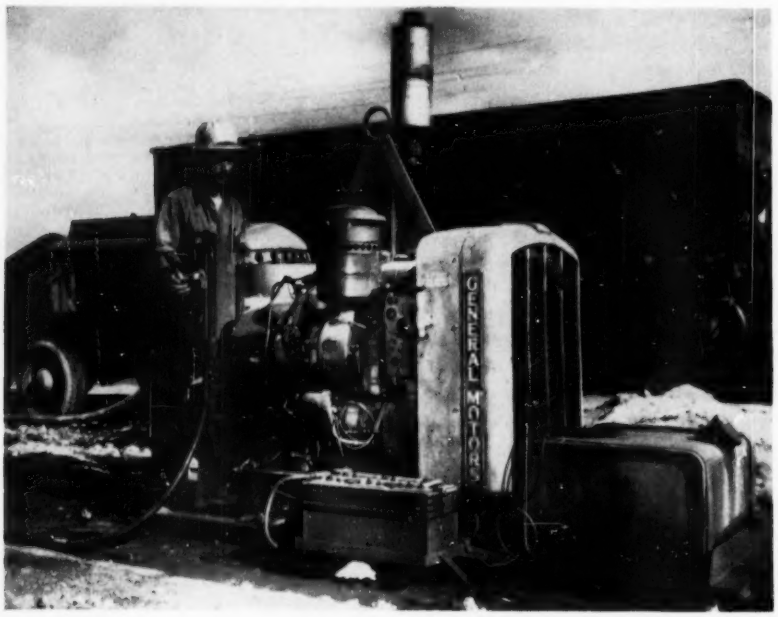
**WHETHER YOU BUILD OR USE** engines, compressors, air-conditioning and ventilating equipment, or *any device using air or liquids* —the chances are there is an Air-Maze filter *engineered* to serve you better. Representatives in all principal cities, or write Air-Maze Corporation, Cleveland 5, Ohio.

**AIR-MAZE**

***The Filter Engineers***

**AIR FILTERS**
**SILENCERS**
**SPARK ARRESTERS**
**LIQUID FILTERS**
**OIL SEPARATORS**
**GREASE FILTERS**

# Field Notes




### *Diesel Powered Mining Machine Relieves Labor Shortage*

When progress on a 24,000-ft. sewer tunnel in Saginaw, Michigan was threatened recently by a shortage of clay miners, the contractor, the Michigan Sewer Construction Co., designed and built two tunneling machines to help with the mining, and completed the project four months ahead of schedule.

Path of the tunnel lay through a clay formation, making the construction of a simple wheel type machine practical. Two such machines were built so that operations could take place at both ends of the tunnel. Both machines were driven by electric motors. The wheels consisted of four spokes with three inch cutter teeth on each wheel, arranged so that they formed a solid cutting front when the wheel was turned.

Power for the cutting wheel motors was supplied by a three-cyl. GM Series 71 diesel driving an ac. generator. The engine ran at high enough speed to be direct connected to the generator, eliminating need of a gear box.

The single engine and generator produced enough power to operate both tunneling machines with sufficient reserve to run a hoist at the shaft opening should the crane normally used to lift material out of the tunnel be needed elsewhere.

## Australian Company Takes Al-Fin License

Rolloy Piston Company Pty. Ltd. of Port Melbourne has signed a license agreement with the Al-Fin Division of the Fairchild Engine and Airplane Corporation, giving them exclusive rights for manufacture in Australia of bi-metallic pistons using a patented Al-Fin process of molecularly bonding aluminum to steel or iron. Under its license, Rolloy also will manufacture bi-metallic brake drums, sleeve bearing and bushings, timing gears, and cylinder barrels.

The Rolloy foundry has a capacity of over 40,000 pistons per month and is one of the largest aluminum foundries in Australia. It manufactures a full range of replacement pistons for all types of engines, automotive and stationary. It is the eleventh licensed to use the patented bonding process. Other foreign countries having this process are England and Germany.

## API Elections

L. S. Wescoat, president of The Pure Oil Company, Chicago was recently elected chairman of the Board of Directors of the American Petroleum Institute at the 31st Annual Meeting. He will succeed W. Alton Jones, president of Cities Service Company.

Frank M. Porter, president of Fain-Porter Drilling Co., was re-elected president of the Institute. P. C. Spencer, president of Sinclair Oil Corp., was elected vice president for the Division of Transportation, succeeding T. E. Swigart, of the Shell Pipe Line Corp., Houston.

All other officers were re-elected.

## Allis-Chalmers Plan Factory Branch

The Tractor Division of Allis-Chalmers Manufacturing Company reports plans for immediate construction of a factory branch to serve agricultural and industrial dealers in eastern Kansas and western Missouri. The facilities will replace the Kansas City branch.

Serving more than 125 industrial and agricultural dealers, the new branch will be complete with conveyor systems, loading platforms, and railroad docks. It is expected to handle a large inventory of harvesting equipment, wheel and crawler tractors, implements, motor graders, power units, and a complete stock of repair parts and accessories for these products.

## C. P. R. Earnings Declined

The Canadian Pacific Railway claims that, while the estimated tonnage to be handled during the year 1951, prepared for the information of the Board of Transport Commissioners, was about realized, on the other hand an increase in working expenses, ow-

ing to higher wages and costs of material and supplies, together with the introduction of the 40-hour work week, resulted in net railway earnings being less than those of 1950 by some $10 million.

Application has been made to the Board of Transport Commissioners for authority to increase their freight rates. The line points out that, after all the outstanding applications have been granted, the increases in charges will have amounted to less than 60 per cent from the levels prevailing before the second World War. Compared with this, wholesale prices in general are now more than 140 per cent higher than at that time and the increases are most marked in commodities essential to railway operation.

### New Raybestos Plant

Raybestos-Manhattan, Inc. announced recently the completion of the initial unit of its new midwestern plant—the Wabash Division at Crawfordsville, Indiana.

The new division will manufacture sintered metal friction elements for tanks and other military vehicles and for the aviation, agricultural and automotive industries, plus other precision parts of powdered metal.

### Perfect Circle Purchase

It was recently announced that Perfect Circle Corporation has signed contracts with the stockholders of the Centrifugal Foundry Company, Muskegon, Michigan, for the purchase of their entire stock holdings on or before March 31, 1952.

Both companies are engaged in the production of centrifugal castings for the manufacture of cylinder liners.

### Pratt & Whitney Moves

New quarters at 683 Lincoln Avenue, Pittsburgh have recently been occupied by Pratt & Whitney Division, Niles-Bement-Pond Company. The building was planned and erected to provide better facilities for handling not only the Pittsburgh area sales operation, but the stocking of cutting tools and gages. Larger quarters have been made necessary by the increased business developed in the Pittsburgh area in precision machine tools, cutting tools and gages manufactured by the company. Sales of automatic turret lathes made by Potter & Johnston Co., a subsidiary, are also handled fom the new location.

### Brazilian Refinery

One of the largest thermofor catalytic cracking units, with a nominal capacity of 25,000 bbl. a day is under construction for a private corporation in Brazil under license from Socony-Vacuum Oil Company, Inc., it was announced recently.

The TTC will be a unit in a refinery being built from the ground up by Refinaria E Exploracao de Petroleo Uniao S. A. It will be of the newest airlift design, one of more than a score licensed to the oil industry outside the Socony-Vacuum organization.

The new refinery will be located at Capuava, in the municipality of Santa Andre, 20 miles from Sao Paulo. Crude oil will be fed to it from a pipeline starting at the seacoast port of Santos, 50 miles away. The pipeline


Briggs OIL CLARIFIERS ON STATIONARY-TRANSPORT-MARINE DIESELS PAY OFF BIG...

...because they keep lube and fuel oils clean--physically and chemically!

11 YEARS AGO, the Rural Cooperative Power Association of Minnesota started using Briggs clarifiers. Now ten, including 3600 H.P. diesel engines in their five operating plants, are Briggs-equipped.

Satisfaction like this proves Briggs' performance is superior. Operating men specify Briggs wherever diesel engines are used. These men know that over the years Briggs keeps lube and fuel oils clean—physically and chemically—keeps engines running better, longer.

Let us run a check on your present filtered oil—send a sample and full engine data. We will put it through our laboratory and give you the report. If new filters are needed, we will recommend type and size.

Briggs Has The Right Filter!

★ A Briggs catalog belongs in your file—write for one TODAY!

Briggs PIONEERS IN MODERN OIL FILTRATION

THE BRIGGS FILTRATION COMPANY
RIVER ROAD, WASHINGTON 16, D. C.

FOR MORE THAN A QUARTER CENTURY

rises 3000 ft. six miles from Santos, to reach the plateau on which Sao Paulo is located.

### Koppers Fuel Processing

The Koppers Company announced recently a new fuels processing section of the research department. The new section will be headed by Dr. E. E. Donath, German scientist and a leader in Germany's war-time synthetic liquid fuels development. Working with him will be C. C. Russell, G. V. McGuri and H. A. Gollmar, experts in coal technology with the company. The program of the new section will be pointed at continued work on coal carbonization and deeper investigation of gasification and hydrogenation of the solid fuel.

Koppers is building a pilot plant at its new Verona, Pa., research center to make gasoline from coal by the hydrogenation process. This process uses powdered coal in a slurry as raw material, the reaction taking place under high pressure.

### Cummins Diesel Sales Purchase

Raymond H. Snyder, former president and treasurer, Snyder Aircraft Division, Air Associates, Chicago, has purchased certain assets of the Chicago operation of Cummins Diesel Sales Corporation. He will operate the Chicago facilities as an independently owned Cummins Dealership with the new company name of Cummins Illinois Engine Sales, Inc.

Headquarters for the new dealership will remain at the same address and the territory assigned includes the 22 counties of Northern Illinois, Scott County, Iowa; and Lake, Porter and La Porte counties in Northern Indiana.

### ASTM Spring Meeting

The American Society for Testing Materials will hold its Spring Meeting from March 5 through 7 at the Hotel Statler in Cleveland.

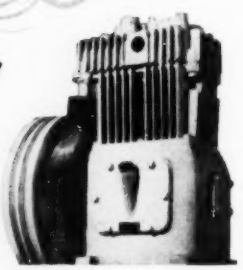
Featured is a symposium on testing metal powders and metal powder products, to be held on March 5. Throughout the week there will be over 300 meetings of technical committees during what is known as ASTM committee week.

### Diesels in Africa

The Owen Falls Power Scheme in Uganda is the first installment of a scheme for harnessing the water power of the Nile between Lake Victoria in Uganda and the Sudan. The position of the new dam is between Lake Victoria and Lake Kioga.

The construction of these large works naturally creates a demand for electrical power for operating the civil engineering appliances used in construction and also in connection with the housing of the men employed. To provide this electrical power, Messrs. Harland & Wolff, Ltd., of England have supplied 15 diesel generator sets having a combined output at site of 14,000 kw. divided between two generating stations, one at Kampala and the other at Njeru together with all necessary equipment. Eleven engines


SO MUCH DEPENDS ON IT!



IN YOUR BUSINESS . .

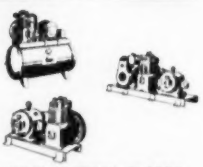
Quincy COMPRESSORS

FOR DEPENDABLE

COMPRESSED AIR SUPPLY

When choosing a compressor, dependability is a big item to consider. Quincy Compressors have a reputation for delivering the required compressed air supply day in and day out. In addition, Quincy Compressors are modern . . . compact . . . rugged.

There's a Quincy Compressor for *your* job! Depend on a Quincy specialist to help you select the type and size (from 1 to 90 c.f.m.) to meet your specific needs. Write Dept. J-23 for details.



ONLY QUINCY OFFERS ALL THESE FEATURES

- Timken Bearings
- Lynite Rods
- Perfectly Balanced Crankshaft
- Copper-Finned Intercooler
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*Quincy Manufactures Air Compressors Exclusively*

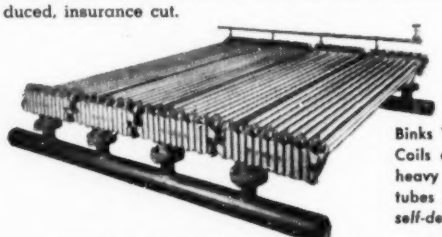
BIG LOSS

if engine heat

travels this little extra distance!

*A 1/16 in. thick deposit of calcium carbonate in the jacket of an engine hinders heat transfer to the cooling water as much as 3-3/16 in. of cast iron.** That's why scale deposits mean poor cooling... decrease engine efficiency.

With Binks closed type heat exchange coils (installed in a Binks cooling tower), you can economically use soft or treated water for cooling purposes. You simply circulate it through a closed system from jacket to coil and back. No scale forms, breakdowns are reduced, insurance cut.



Binks Type "D" Coils are built of heavy 1" O.D. copper tubes and are *self-descaling*

SEND FOR BULLETIN 41

Gives complete details, drawings and tables of heat exchange coils adaptable to a variety of diesel operating conditions.

*Courtesy, D. W. Haering and Co., Inc.

Binks MANUFACTURING COMPANY

3114-38 Carroll Ave., Chicago 12, Ill.

REPRESENTATIVES IN ALL PRINCIPAL CITIES

Cut Down the
OVERHEAD!

RENEW CYLINDERS AND CRANKSHAFTS—NO MATTER HOW BADLY WORN—WITH VANDERLOY M and PORUS-KROME

For Less Than the Price of Replacements

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PORUS - KROME VAN DER HORST
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IN ROTARY PUMPS
VIKING Has the Answer to Your Needs

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LIGHT or HEAVY LIQUIDS
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CORROSIVE MATERIALS
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PECULIAR Mounting Conditions

Whatever your pumping needs may be, start solving them today by requesting folder 528D.

See Our Catalog in SWEET'S

VIKING AN HONORED NAME IN PUMPING

Viking PUMP COMPANY
CEDAR FALLS, IOWA

are installed at Njeru and four at Kampala. All these engines are arranged for turbo-blower pressure induction.

### Federal-Mogul to Sell Bower Bearings

An agreement has been completed through which Federal-Mogul Service, division of Federal-Mogul Corporation, will take over world-wide sales and distribution of Bower tapered and straight roller bearings for all replacement service. A similar arrangement has been in effect for the domestic United States trade with very successful results.

### Catalyst for Improved Combustion Efficiency

Successful completion of tests relating to a new theory and process designed to eliminate knock and carbon formation by more efficient combustion was recently announced by the Associated Research and Development Corporation, 150 Broadway, New York. The work was based on research by Dr. Sophia Berkman, a recognized authority on the phenomena of catalysis.

Underlying Dr. Berkman's process is the theory that when crude oil was formed it acquired its chemical structure as a result of the varying catalytic action of minerals in the earth's strata. This accounts for the chemical differences of crudes even in adjacent fields. Dr. Berkman postulates that the process is reversable and that selected minerals and ores, through individual catalytic action, could control the type and rate of combustion in engines.

Selectively chosen natural ores and minerals are compounded and regrouped into a "synthetic ore" that is cast into the cylinder chamber. The catalytic surface exposed to the fuel mixture alters the combustion process without undergoing any change itself.

Fairly extensive tests have been conducted to test the validity of the theory and process. Most have been in CFR engines with some in single-cylinder engines. Various gasolines were used for fuel. Reported performance data would indicate gains of up to 25 octane numbers. In other words, current high compression gasoline engines could be operated knock and carbon free while using 60 octane gasoline or, with current gasolines, much higher compression ratios are possible.

When specifically asked about diesel application, Dr. Berkman commented that no work had been done on it but that there was no reason within the framework of the theory why burning could not be accelerated as well as slowed down. It was pointed out that the purpose of the tests was to prove the validity of the theory and that this had been done. Further work would be required in each field of application to "tailor-make" the synthetic ore to meet all the variables.

The idea is that the process (fully protected) is to be made available in various fields on a non-exclusive license basis. Applications are envisioned as embracing all industries using petroleum fuels and petroleum refining as well.

# Organizational News

## Purolator Appointment

Appointment of Joseph G. Van Nest to the newly created position of Director of Purchases for Purolator Products, Inc. was announced recently. He was formerly general purchasing agent for the Mack Manufacturing Corporation.

*Joseph G. Van Nest*

## GM Elects

The Board of Directors of General Motors at a recent meeting elected Dr. Karl T. Compton a member of the board. Former president of the Massachusetts Institute of Technology, he is now chairman of the corporation of M. I. T. and also chairman of the research and development board of the National Military Establishment.

Dr. Compton has been chairman of the Joint Chief of Staff evaluation board on atomic bomb tests since 1946 and is a member of the War Department research advisory panel, the Naval research advisory committee and the National Defense Research Committee.

Also elected was General Lucius D. Clay as a member of the Financial Policy Committee. General Clay, chairman of the board of the Continental Can Company, is a director of GM. He succeeds John L. Pratt, who has resigned from the Financial Policy Committee, but who will remain a member of the Board of Directors.

## Canadian Railway Diesel Men

Harry Taylor and Raymond Hickey were recently appointed diesel supervisors for the Atlantic Region of the Canadian National Railways.

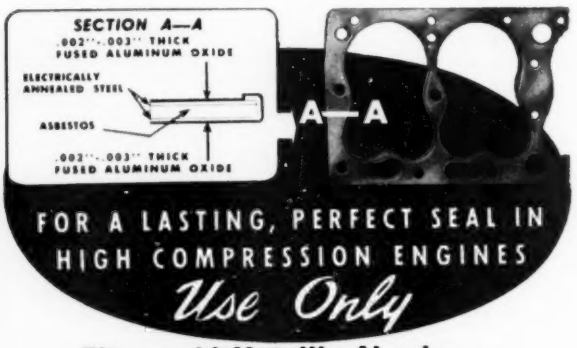
Mr. Taylor joined the C.N.R. in 1933 and became assistant mechanical engineer at Moncton in 1947. Mr. Hickey started in 1935 as a machinist's apprentice. He later moved to the railway's electrical field where in 1947 he was appointed chief electrician for the Borden Ferry service.

## Worthington Man Retires

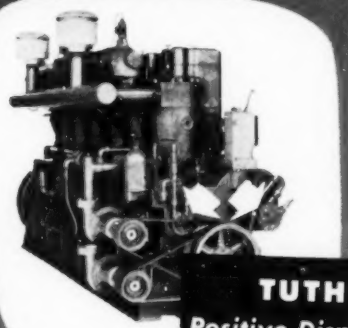
Herman H. Miller, an authority on compressors, recently retired from the Worthington Pump and Machinery Corporation after 50 years of service.

*Herman H. Miller*

In 1901 as an application engineer he joined the Laidlaw-Dunn-Gordon Company of Cincinnati, a subsidiary



For POSITIVE LUBRICATION



TUTHILL
Positive Displacement
PUMPS

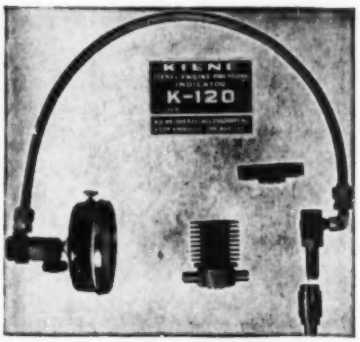
There's no place for guesswork in the lubrication of diesel engines and power units. Tuthill pumps provide a positive method of lubricating and scavenging. Dependable, economical automatic reversing pumps and stripped models for incorporating directly into the design of your engine are available to meet any lubrication requirement. Send your specifications for recommendations on the Tuthill pumps best suited to your needs.

25th Anniversary

TUTHILL PUMP COMPANY
939 E. 95th Street, Chicago 19, Illinois



KIENE MODEL K-120 UNIVERSAL PEAK PRESSURE INDICATOR




Model K-120 with cooler body and nozzle dummy.

MODEL K-120 Indicator has but one moving part—nothing to wear or get out of adjustment.

VALVE—Gas trap type with diaphragm type check valve having adjustable lift. Stainless steel valve and seat.

No springs—No pistons—no complicated adjustments — No temperature corrections — no pressure loss in check valve.

GAGE READS TRUE PRESSURE—MAY BE RECALIBRATED ON ANY GAGE TESTER

Check readings can be made over and over again by releasing indicated pressures with bleeder valve.

GAGE—Hydraulic 3½ inch dead weight tested in suitable range to specification requirements.

ADAPTORS available for most models of engines manufactured in U.S.A. Other models made to order at reasonable prices.

For Testing Firing and Compression Pressures on all Models of Diesel and Gas Engines.

Dependable — Easy to Use — Rugged. May be Used With or Without Flexible Tube.

DESCRIPTIVE BULLETINS AND PRICES FURNISHED ON REQUEST

Manufactured under patents No. 2280411, No. 2328328, others pending

KIENE DIESEL ACCESSORIES, INC.
10352 PACIFIC AVE., FRANKLIN PARK, ILLINOIS


of International Steam Pump Company, which later became the Worthington Pump and Machinery Corporation.

Ten years later he became manager of the Air Compressor Department at Worthington's New York office and in 1915 became sales manager of the Cincinnati plant. In 1932 he became manager of the Compressor Division when the Cincinnati plant was consolidated with the Buffalo plant.

## Waukesha Advertising Manager

The Waukesha Motor Company has announced the appointment of Harry

*Harry J. Lemmer*

J. Lemmer as advertising manager. He entered the company in 1942, following a number of years as Chicago passenger traffic representative for the Union Pacific Railroad and service in the passenger and promotion departments of the Illinois Central and Chicago Great Western Railroads.

During the war Mr. Lemmer acted as Technical Information Manager and supervised the publication of technical manuals ordered by the Armed Services. In 1946 he assumed the duties of assistant advertising manager and served in the capacity for five years.

## Allis-Chalmers Appoints

William M. Wallace has been appointed an assistant to the vice president of Allis-Chalmers general machinery division.

Since 1947 Wallace has been special assistant to G. V. Woody, manager of the processing machinery department. He entered the company's employ in 1937 after graduation as a mechanical engineer from Alabama Polytechnic Institute. He was a sales representative in the Denver and Pittsburgh district offices before entering the processing machinery department. In 1951 he received a master's degree in business and engineering administration from Massachusetts Institute of Technology following a year of study under a Sloan fellowship.

## Cuno Vice President

The Cuno Engineering Corporation, Meriden, Conn., elected Carlton H. Winslow vice president in charge of

*Carlton H. Winslow*

sales. He was assistant general manager and has been with the firm for 18 years.

## SAE Elections

Election of Dr. Daniel P. Barnard IV, research coordinator of Standard

Oil Company (Indiana), as president for 1952 of the Society of Automotive Engineers was announced recently. He succeeds Dale Roeder of Ford Motor Company, who served during 1951.

Also elected were twelve 1952 vice presidents, each heading an SAE Professional Activity. Mr. W. G. Ainsley, of Sinclair Research Laboratories, Inc. was elected vice president in charge of Diesel Engines.

### Fairbanks, Morse Changes

The following changes have recently been announced by Fairbanks, Morse & Company:

J. A. Cuneo

Milo C. Roy

J. A. Cuneo, formerly manager of the Chicago branch has been promoted to general sales manager. Milo C. Roy, formerly manager of the Omaha branch, replaces Mr. Cuneo as manager in Chicago. J. W. Wright, formerly manager of the Diesel Sales Division, with headquarters in Chicago, has been appointed manager of the Omaha branch. He is replaced by C. E. Dietle, formerly diesel department manager of the Chicago branch. W. B. Wylly, formerly manager of the Houston, Texas sub-branch has been appointed manager of the Atlanta branch. L. A. Weom, formerly manager of the St. Louis branch, has been transferred to St. Paul as branch manager to succeed A. C. Tompson, retired. Clifford J. Schroeer, formerly diesel department manager at St. Louis, replaces Mr. Weom as manager of the St. Louis branch.

In accordance with a new autonomous operation for the Electrical and Scale Divisions the following changes have been made:

Gordon R. Anderson, manager of the Freeport Works, has been promoted to general manager of the Electrical Division, and George C. Worthley, manager of the Scale Division has been promoted to general manager of the scale division. Joe Peterson has been made sales manager of that division.

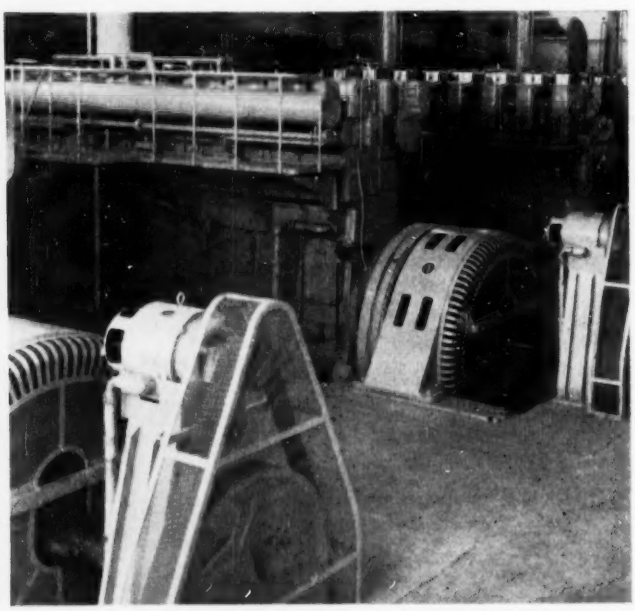
### Cooper-Bessemer Assignment

T. M. Lamberth, Jr. has been assigned to the post of sales and engineering representative of the Cooper-Bessemer Corporation's Shreveport, Louisiana office.

T. M. Lamberth, Jr.

Mr. Lamberth's activities will be devoted principally to the engineering

(*Continued on page* 89)

TWO IDEAL GENERATORS INSTALLED AT THE CRESTON, IOWA MUNICIPAL PLANT.

Rating of each: 1100 kw., 1375 kva, 0.8 p.f. 2400 volts, 3 phase, 60 cycles, 327 R.P.M. with IDEAL 125 volt, 20 kw chain driven exciters.

*Buy Ideal Generators...*

V TIME PROVEN

Built by builders of high quality power equipment since 1903.

V ENGINEERED TO SPECIFICATIONS

by Engineers with know-how and years of experience. There is no substitute for either.

V CAREFULLY BUILT

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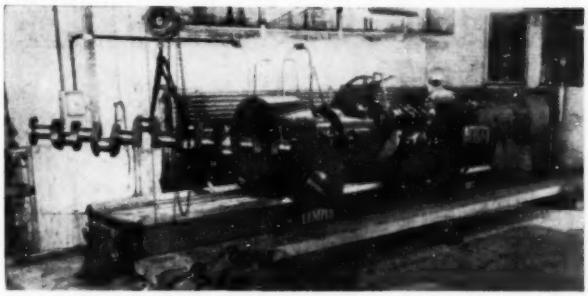

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## *Servicing Bendix-Scintilla Nozzle Valves*

(*Continued from page 63*)

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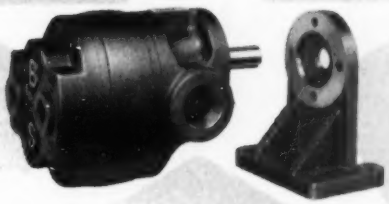

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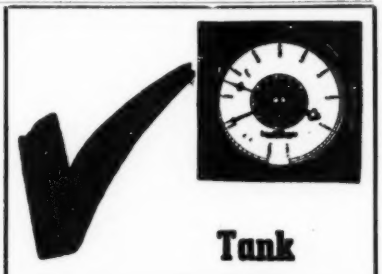

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## Organizational News

(*Continued from page 87*)

application of gas, gas-diesel and diesel engines, as well as compressors and pumps widely used in the transmission of gas and oil in petroleum and chemical processing.

A mechanical engineering graduate from Texas A. & M., he had been associated with the company in Mount Vernon and formerly was a sales engineer with Joseph A. Coy Co. and Arrow Industrial Manufacturing Co., both manufacturers of heat transfer equipment.

### "Cat" Retirement

The retirement of vice president John V. Munro of Caterpillar Tractor Company was announced recently.

*John V. Munro*

Mr. Munro has been with the company since its formation in 1925. Born in Canada, he came to the United States at the age of 14 and gained his early business experience with the American Can Company and Kinsey Manufacturing Company, both of Toledo, Ohio.

He later joined C. L. Best Company of San Leandro, California, a predecessor of Caterpillar, in 1921 as purchasing agent, and moved to Peoria in 1925 as purchasing agent and became vice president in 1926. In this capacity he was instrumental in developing purchasing policies.

### Borg-Warner Promotes

W. W. Kovalick has been promoted from chief engineer to production manager of the Chicago plant of the Ingersoll Products Division of Borg-Warner Corporation.

He succeeds J. W. Dean, resigned. T. H. Burke, formerly chief tool engineer, will become acting chief engineer.

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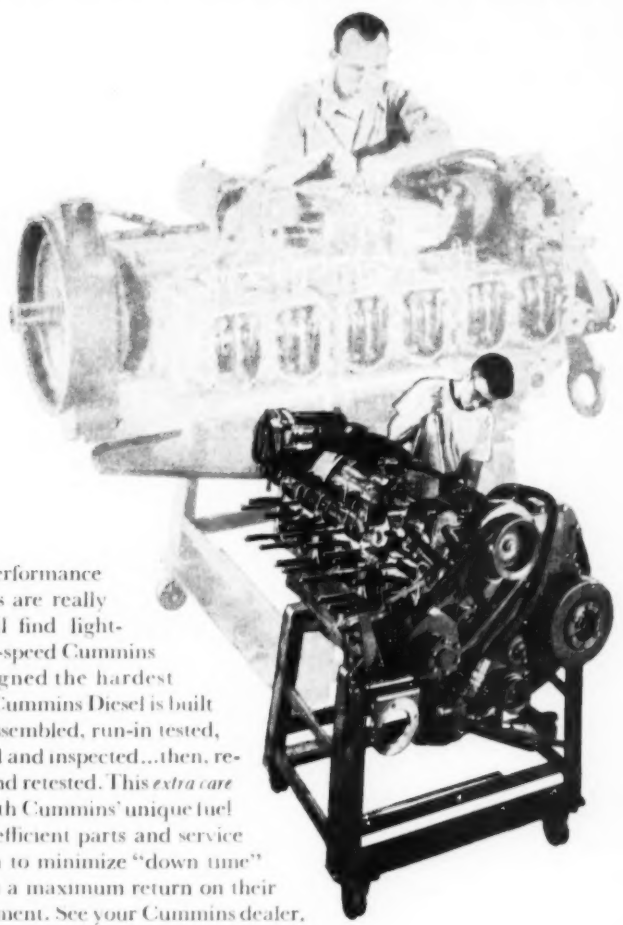

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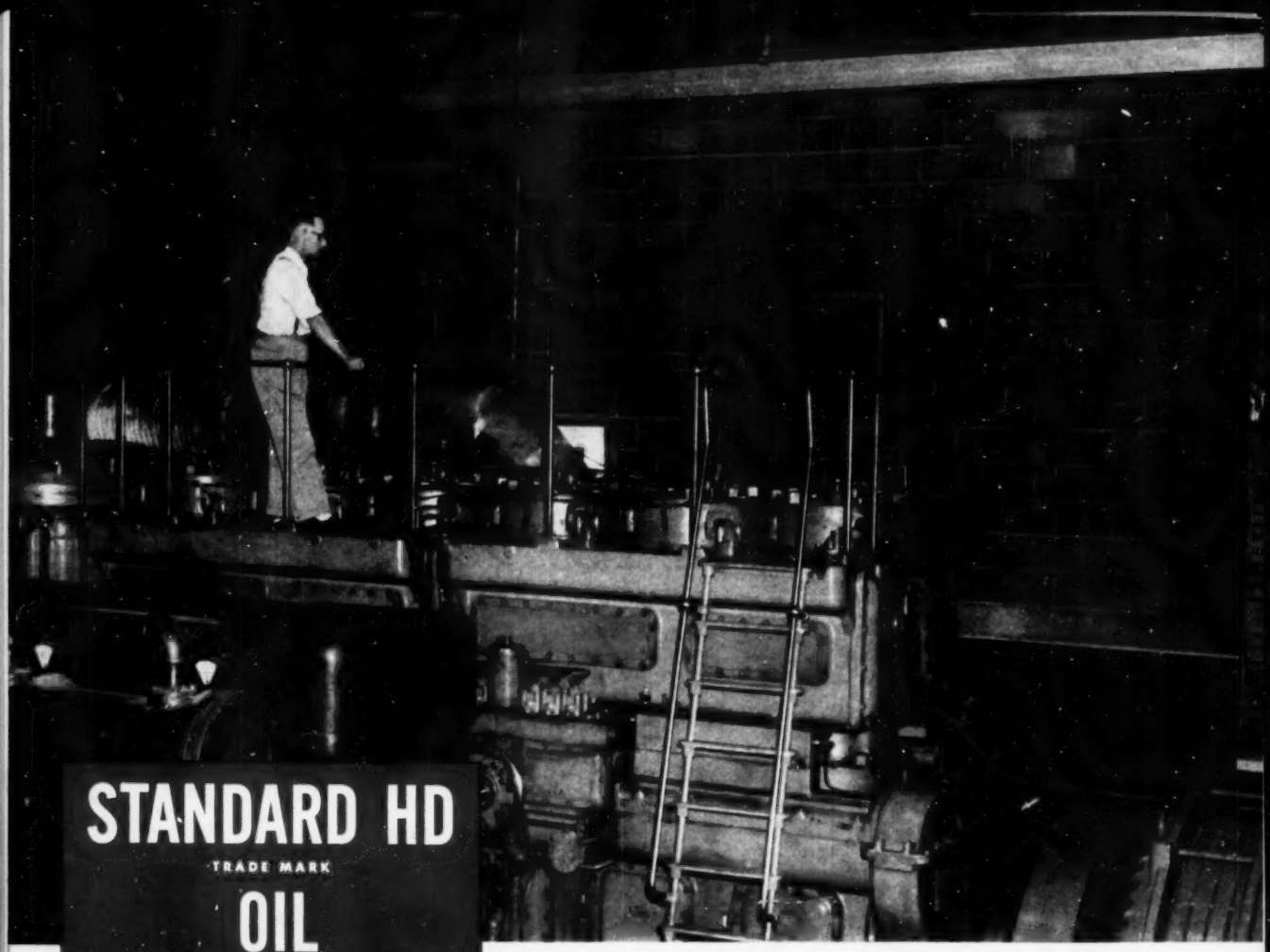


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